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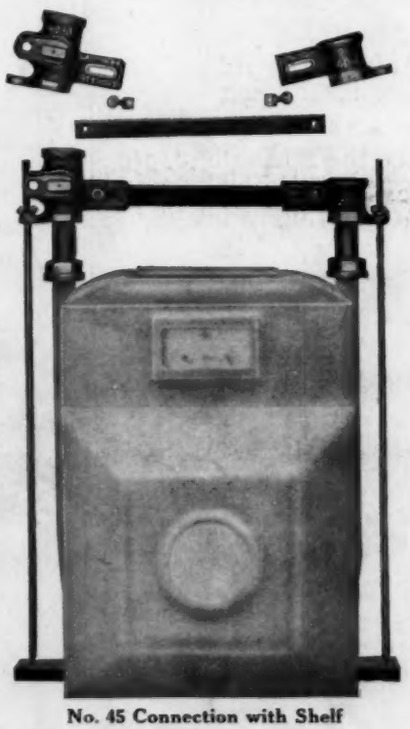
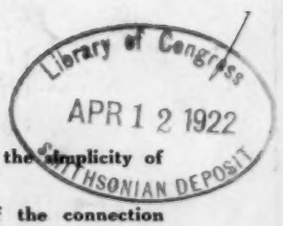
Lattimer-Stevens
Meter Connections



No. 45 Connection with Shelf

(Red brass lock wing cock built into inlet end)



The accompanying illustrations indicate the simplicity of the No. 45 connection.

The meter setter uses the inlet end of the connection 40-3 in place of a stop-cock. The outlet end 40-2 takes the place of the coupling.

Meter Shelf

The illustrations also show how the hanger shelf is attached to the No. 45 connection.

With this shelf there is practically no chance for leaks due to washer shrinkage, since the meter is held up tightly at all times against the swivel connections.

Furthermore, there is no chance for strain due to sagging pipes, which often make trouble when the meter setter depends on a bracket shelf instead of fastening his piping up securely. Strain caused by the sagging of the bracket shelf itself is also eliminated.

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KOPPERS LIQUID GAS PURIFICATION

The Modern Process

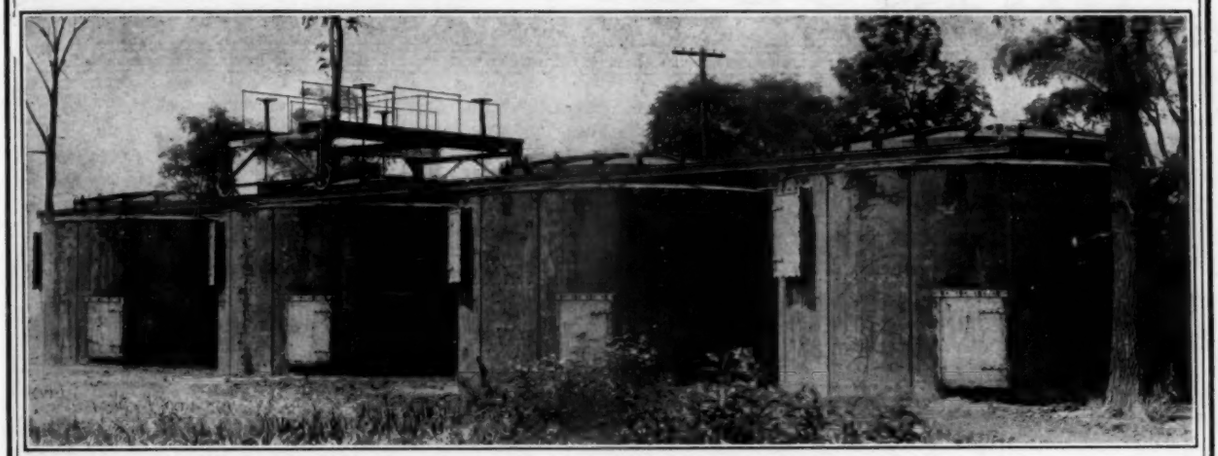
WHEN CONTEMPLATING an increase in Purifying Capacity—give careful consideration to Koppers Liquid Gas Purification.

The story of the development of this process makes very interesting reading—but—the most interesting part of it to the gas manufacturer is the saving it will effect in the cost of purifying his gas and the efficient and flexible operation possible by its use.

The Battle Creek Gas Company at Battle Creek, Michigan, has just given us a contract for a 2,000,000 ft. Liquid Purification Plant. This plant will be operated in connection with their present oxide purifiers, the liquid purification plant removing hydrogen sulphide down to 50 grains, from gas containing as much as 700 to 900 grains, and the oxide purifiers the remainder. Figures on this proposition show that their total purifying cost will not exceed one-half cent per M.

May we have the opportunity of presenting more detailed information and working out a proposition to meet your particular requirements?

THE KOPPERS COMPANY
PITTSBURGH, PA.



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American Gas Journal

SIXTY-THIRD YEAR

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Western Office, Peoples' Gas Building, Chicago, Ill.—Roy W. Brown, Manager
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Gas—the Fuel of the Future

Some Conclusions Drawn from a Careful Study of the Subject

By THOMSON KING, Baltimore, Md.

Throughout the tremendously long, slow and laborious process by which man has raised himself from the level of the ape-like savage to his present wonderful and complex civilization, fire and the heat it yielded has ever been his most fundamental, necessary and powerful tool and servant. Until he learned how to use heat he could be nothing but a savage, maintaining a precarious and miserable existence, at the mercy of nature. He could not protect himself from the rigors of winter, nourish himself with cooked food nor shape a metal weapon or tool. Learning how to make a fire and use heat made him master of his environment, the conqueror of nature, and started him upon the path of progress which stretches before us to-day, leading on to ever grander conquests and the unimagined wonders of the future.

It is an impressive array of facts that Mr. King presents to prove that gas truly is "The Fuel of the Future." We are sure that the statements made are going to be of immense value to the gas industry.—Editor.

As the progress of mankind in the past has rested upon heat processes, so his future progress must be even more dependent upon his ability to use heat processes Since to use heat he must find fuel, there is no more vitally important question confronting us to-day than that of our future fuel supply. By fuel, as we shall use the term in this discussion, we mean to include any and all substances or forms of energy capable of producing heat and available for the uses of man. Under this broad sense, fuel is no longer restricted to something that can be burned. Electricity generated from water power becomes fuel, for it is a potential source of heat.

We have stated what we mean by fuel; it may be well to also state what we mean by future. It is an infinite term if not defined by limitations. We cannot deal with it in its infinite sense. We must limit it to the scope of our vision. By future, we mean the time ahead of us through which our present knowledge allows us to project estimates and speculations with a reasonable degree of accuracy and assurance.

The conclusion expressed in the title of this article is the inevitable and unescapable result at which we must arrive from a careful consideration of conditions as they exist in our world to-day. The dominant fuel of the future will not be solid; it will not be liquid; it will not be electric; it will be gas. Just what kind of gas it will be we cannot say. How it will be made, distributed and sold, whether from isolated plants or great central systems, this and many other considerations are interesting subjects for speculation and argument; but the great fact that it will be gas looms upon our horizon and casts its shadow before it.

We do not mean to imply that gas will be the only fuel in general use at any time in our future. Each form of fuel has its field, large or small, in which it will be master by reason of special characteristics. For marine work, liquid fuel has great advantages, it is easy to load on ships, it requires little labor to handle it, it occupies less bunker space than any other form. As long as it is possible to obtain liquid fuel at costs comparable to other forms, it will be preferred for marine work. Likewise, for automotive vehicles and aeroplanes, the internal combustion engine and liquid fuel surpass any other combinations.

On the other hand, for great power plants and certain kindred uses, solid fuel in some form will be largely used, as we see the future for the next few hundred years; but for general industrial, commercial and domestic use gas fuel will be supreme in all thickly populated parts of the world.

Let us briefly examine the facts and principles on which our statements and faith rest. We may best begin an examination of our fuel sources, reserves and possibilities as we know them to-day. These resources naturally fall into two classes: First, those that are already used on a large scale; and second, those which have not been drawn upon but which

may become sources of heat energy on a large scale in the future.

The first class contains our high and medium grade coals, petroleum that will flow or can be pumped from oil sands, natural gas, wood and vegetable products and liquids and gases derived from them, and electricity from water power.

The second class contains our low-grade coals, lignite and peat; petroleum in oil sands that cannot be gotten by flow or pumping; oil shales; wind, wave and tide power; the internal heat of the earth; the radiant heat from the sun; atomic energy.

In considering these great divisions of our fuel, present and potential, we will take them in order as we can most cearly see the part they are to play in the future.

Natural Gas

Of all our fuels, natural gas has the shortest life. It did not attain great importance until the latter part of the nineteenth century and it will sink into insignificance before the end of the twentieth. Even to-day, fields are becoming exhausted and production is declining; our knowledge of this subject practically guarantees that there are no vast undiscovered deposits that will prolong the importance of this wonderful fuel beyond the present century. We have halved the life of our heritage by shameful waste and useless extravagance. Indeed, it is possible that in the short space of twenty years from now natural gas will have shrunk into comparative unimportance as a major fuel. Although, in certain districts of the earth, it may be used on a small scale, principally for domestic purposes, for a much longer period. Its larger users of to-day must turn to other sources and less ideal fuels to-morrow. We can only say, "It was a good fuel and cheap while it lasted; we shall not see its like again."

Petroleum

What has been said of the approaching exhaustion and diminishing importance of natural gas can be said in a lesser degree of oil. Our knowledge is less certain and assured as to our reserves and undiscovered fields, but no less certain as to the ultimate result. Our known fields are being used at a rate that brings their exhaustion in sight and our experience teaches us that the fields that will be discovered in the future will not have a long life.

As the easily obtained petroleum is exhausted, its cost will rise and its use will be more and more restricted. The cruder and less efficient uses and those uses for which other fuels will serve as well will be discontinued, and a greater proportion of the crude oil will be converted into gasoline, the lighter distillates and lubricating oils. The use of oil as a fuel for boilers and industrial furnaces on land cannot continue very much longer. It appears certain that long before the end of the present century the use of crude oil or any of its derivations or fractions for such purposes will have ceased to be of large importance in the world, and that in the next few decades we will see its importance as a fuel become restricted to certain especial conditions such as marine work and internal combustion engines.

Wood and Vegetable Products

Turning to wood and other vegetable products, we see that there is a fundamental difference between these and the natural gas and oil that we have been discussing, in that here we have a fuel source that is constantly replenished by nature. It appears certain that the use of this class of fuels in the future will continue very much as at present until such time as our mineral fuels have been so far depleted that they have become relatively much more costly than they are to-day. So much for the near future, but for the more remote time that lies beyond the scope of this article, we can dimly discern interesting possibilities which we will only venture to suggest in the briefest terms.

The rate of plant growth depends very largely on the proportions of carbon dioxide in the air. The great proportion of plant tissue is carbon and this carbon comes from the CO_2 in the air. In the carboniferous period when the rank and rapid vegetable growth from which our coals were formed was taking place, the earth's atmosphere must have contained a much higher percentage of CO_2 than it does to-day. When we burn coal, petroleum, gas or wood, we put carbon back into the atmosphere in the form of CO_2.

Let us suppose the actual amount of carbon now burned in the world in the shape of coal, oil, gas and wood to be 1,500,000,000 short tons per year. Each pound of carbon unites with 2.66 pounds of oxygen, hence the amount of CO_2 liberated into our atmosphere by our fires in a year is 5,490,000,000 tons. At first it seems as if this enormous annual addition must soon have a decided effect on our atmosphere, which now contains only 0.03 per cent of CO_2, but since this small percentage amounts roughly to 2,614,590 tons, we see that it would take 476 years to double the amount now in the air, even though no CO_2 was being used up by vegetation. Since the amount so used is enormous, it is evident that the effect of the present rate at which we are releasing CO_2 into our atmosphere will be very slow. Nevertheless, the time may come as our use of fuel increases when the rate of vegetable growth may be enormously increased by an increasing percentage of CO_2 in the air.

It has been estimated that plant growth now produces annually 32,000,000,000 tons of vegetable matter which, if burned, would develop heat equivalent to that derived from 18,000,000,000 tons of coal. It is certain that in the far distant future this vast quantity of potential fuel cannot fail to play a more important part in the world's supply than it does to-day, especially by supplying liquid fuels such as alcohol for internal combustion engines and gas for all purposes.

Hydro-Electric Power

Electricity from water power is a very convenient source of heat. What part will it play in the future? An examination of the facts shows us that it must be a relatively small factor except in those parts of the earth that have not been blessed with deposits of mineral fuel. The future possibilities of this source are probably better known to-day than any we have

(*Continued on page* 332.)

Control of Gas Pressures by Distant Indication

A Discovery That Has Been Proved in Actual Work

By GEORGE WEHRLE, Superintendent Gas Department, Denver Gas & Electric Light Company

The pressure carried upon any kind of a gas distribution system is determined by the requirement of the low points to maintain adequate pressure in every part of the system. Where a distribution system is divided into several separate parts or districts centering at one pressure station, or where a number of pressure stations are maintained, there will likely be more than one pressure control point, the maintenance of sufficient pressure at which provides adequate pressures to every part of the system.

For the sake of convenience gas distribution systems may be divided into two classes, namely: high-pressure systems and low-pressure systems. In the former are included systems where separate transmission mains are used to convey gas to governor stations, and in the latter systems distributing from the plant or holder stations through feeder mains at variable pressures, which are themselves a part of the supply system. The principal difference between the two classes is that in the one the gas pressure is regulated to the customer by the use of district governors, and in the other by station pressure regulation or by the use of individual service governors. Either of the two systems promotes the same end: maintenance of efficient utilization pressure at the consumer's appliance. Since gas utilization is most generally carried on at relatively low pressures, measured in inches of water column, higher pressures are used for another purpose—that of propelling the gas to the point of utilization at the best efficiency of conductivity in the distribution system.

Since pressure is the propelling force of the gas, nothing is gained in carrying pressures higher than required to deliver the amount of gas demanded to the most remote customer, yet even the most remote customer on the system should be supplied with pressure sufficient for the efficient operation of his application, but no more. Therefore each distribution system has as its control of pressure some certain district, or districts, which determines the pressure to be carried on the system or has at some point in its transmission lines a place where a certain pressure must be maintained in order to deliver the volume of gas required. A knowledge of the pressure at the controlling points at all times is of vital necessity to the station if the greatest efficiency of delivery is to be attained. Otherwise impaired service to the customer or excess of lost and unaccounted-for gas may result.

This discovery described by Mr. Wehrle will be of immense value in gas distribution, we believe. The subject is thoroughly discussed and the operation accurately described. A distinct step in progress has been made.—Editor.

Need Is Apparent

In those distribution systems herein designated as low-pressure systems the need of distant pressure-indicating devices is most apparent. In such systems station pressures vary as the demand during the day, while the demand may vary from day to day to such an extent that predetermined schedules become uncertain factors to satisfactory service in the remote districts or low points. With remote control of pressures, where the pressure at the lowest point in the system is known to the station operator at all times, the station pressure can be so regulated that constant utilization pressure is maintained at the weakest point in the system.

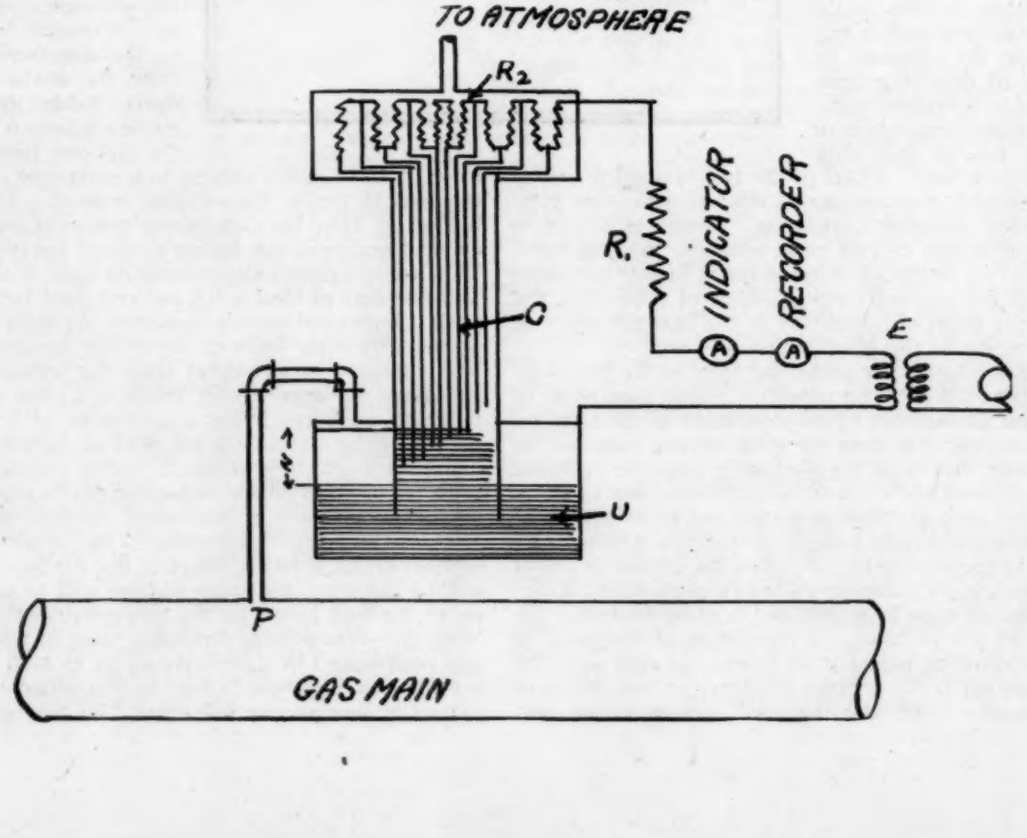
The pressure system in Denver may be called a low-pressure system grown up. Pressure is supplied to the distribution system from the works and three district holder stations. Variable pressure is carried at the stations from a minimum of 10 in. water column to a maximum of 3 lb., as required to supply the variable demand. The district holders fill from the distribution system at times of low demand and send out during times of heavier demand. They are in a measure compensating tanks in the system, with the desired ideal a 100 per cent load factor on the plant. Individual service regulators are installed on approximately three-fifths of the 50,000 services supplied. The regulated areas extend from the pressure stations and along the larger feeder mains to a point where distribution pressures attain a maximum of 6 in. water column. These areas are extended as the increased demand from year to year causes higher station pressures to be carried and which pushes the points where a 6 in. maximum pressure is maintained farther and farther from the stations. Ultimately all but a relatively few services on the extreme fringe of the distribution system will be governed and more stations will be installed to better the load factor on the entire distribution system. With pressures varying through a range of 850 per cent, and complicated by a different range at each station, it is evident that guesswork must be eliminated in pressure control or poor service will result. By having the pres-

sures at the control points indicated at the station the operator knows at all times what the demand is upon the station and carries just the pressure required there to meet this demand.

Series of Experiments

It is only a little over ten years since Denver grew up. Prior to that time ours was the old-fashioned distribution system, using holder pressure and a works governor. After boosters were installed pressures increased rapidly with the increasing demand for gas. At first it was possible to regulate pressures by predetermined schedule worked out from the pressure charts obtained from the extremities of the system, but this soon proved unsatisfactory, as an unusually heavy demand resulted in poor service before we were aware of it. When instruments that would transmit distant pressures were obtainable we installed them and were thus able to know on the instant when pressures were changing at the distant point. Such an instrument must necessarily be so constructed as to be mechanical perfection itself, since a failure at a critical time would result in poor service, if not in a dangerous condition. Our engineers have done considerable work in the nature of perfecting an instrument that would be ruggedly constructed and yet delicate enough to operate on very slight pressure changes, and, above all, foolproof to the maximum extent that its operation would be as reliable as could possibly exist in a mechanical or electrical apparatus. One such home-made instrument was built and is still in operation after five years' use on a short city heating circuit. Our endeavor has been to devise an instrument, with few if any moving parts, to operate on an alternating electric current, thus avoiding the use of batteries, and to measure the pressures by means of proportionate resistance in the flow of electric current. We believed that with such an instrument, properly constructed, our chances of inoperation would be reduced to practically one factor: failure of current supply, which in modern central station operation is a remote possibility.

About a year ago one of our engineers, in looking over a descriptive catalogue of the Republic Flow Meter, discovered that here was the instrument we were looking for, and no time was wasted in taking the matter up with the meter company's engineers and in having one of their instruments installed as a distant pressure indicator and recorder. Its use has been perfectly satisfactory in every way, and we see no reason why its satisfactory operation should not be continued indefinitely. The instrument consists of the regular meter body installed at the control point in the system and connected with the indicator and recorder at the station through a metallic circuit. The indicator dial and recording chart were calibrated to read in inches of water pressure from 0 to 7½ in., which was the range we desired, although the calibration can be made in any unit or range required to meet a certain condition. The change necessitated in the meter to convert it from a regular flow meter to a pressure meter was the elimination of the dynamic tube from the inside of the pipe and the substitution of a pipe to the atmosphere, thus measuring the difference between the static pressure within the pipe and the atmosphere, instead of the differential between dynamic and static pressures used in measuring flows. The resistances in the meter body were designed to properly cover the range of pressure required. One hundred and ten volt alternating current from the ordinary lighting circuits is used, with proper transforming to maintain a constant low voltage on the instruments. The control point where this instrument is



now used is one and one-quarter miles distant from the plant, although there is no limit to the distance which may be employed between the meter and register, provided electrical laws governing conductivity of current are followed.

Discovery of Great Importance

We believe the discovery of the use of the Republic Flow Meter as a distant registrar of gas pressures fills a long-felt want in the gas industry, and it is for the purpose of acquainting men in the industry of this fact that this article is written. For the benefit of those who may not be familiar with the operation of the Republic meter a brief description follows. We would advise, however, that any who have use for the meter take their specific problems up with the engineers of the company so that the installation will be properly designed to meet the condition required of it.

The meter body is located at the point where the measurements are desired. It consists of a compact cast-iron case containing a mercury well, contact chamber, resistances, seal, etc. The pressure pipe from the gas main leads to the mercury well, and the connection to atmosphere leads from the contact chamber. The pressure within the main causes the mercury in the well to be depressed and raised in the contact chamber in proportion to the pressure in the main. The rise and fall of the mercury in the contact chamber engages or disengages the successive ends of the overhanging rods, and thus adds or cuts out a given part of the resistance to which the rods are connected, regulating the amount of current flowing through the electric circuit. The resistances are so divided by the contact rods that the flow of current in the circuit is directly proportional to the pressure of gas in the main. The electrical instruments, while measuring the current regulated by the pressure, actually register the amount of pressure in the pipe.

The instantaneous flow of current shown by the indicator and recorder on the panel-board of the station is equivalent to the instantaneous pressure existing within the pipe, while the record registered on the chart of the

(*Continued on page* 335.)

Outside Producers at Racine

Some Results That Have Been Secured

By H. R. BROKER, Racine, Wis.

The present gas plant at Racine was built about twenty years ago and laid out to supply gas to Racine only. Later on high-pressure lines were run to Kenosha, South Milwaukee and Cudahy, and gas manufactured at Racine was supplied these towns. The population then supplied was about double that for which the plant was originally planned. Due to this change and a rapid increase in gas used, the retort house was extended rapidly along the lines of the original plans, with the exception of changing from stop-end to 12-ft.-through retorts, utilizing the original arches. During this rapid development the retort-house equipment became quite extensive, consisting of a large number of small units.

Following the war period, unsettled labor conditions presented a serious problem. Especially during the summer of 1920 it became apparent that more modern methods of retort-house operation would have to be considered. First, a system which would eliminate a large amount of the manual labor was necessary; second, it was desired to reduce bench fuel costs. After considerable investigation and experimenting, it was believed that through the use of producer gas from an outside plant the desired improvements would probably be obtained and give a plant capable of making gas at a lower cost without building a new carbonizing plant of larger units and abandoning the old equipment, which was worth approximately one-half million dollars.

The coal-gas plant at Racine consists of fifty rear clinker benches of six 12-ft.-through retorts, placed in two rows of twenty-five back to back, with 12-ft. space intervening. A De Brouwer coke conveyor runs the length of the house between the two rows on a level with the charging floor. Beneath this conveyor is a closed tunnel about 6 ft. high, the rear walls of the benches forming the sides. Clinkering and tending the furnaces from this tunnel was disagreeable work, due to the heat and poor ventilation. Furthermore, all the ashes had to be hauled out at one end of the tunnel in wheelbarrows an average distance of 200 ft.

From this slight description of the plant the reader will realize that clinkering, firing and removing ashes from these fifty furnaces, all of which was manual labor, required a large number of man-hours daily, with consequent excessive costs.

Coal-gas benches are rarely equipped with producers with sufficient grate area to burn any but the best grades of coal or coke, and the Racine plant was no exception to the rule further than being tied to coke fuel due to excessive expense in handling coal.

The larger sizes of coke have had a much higher sale value during the past and this will no doubt continue so.

It was determined that producers could be installed that would gasify successfully a mixture of braize and small coke, thus reducing the cost or value of the fuel per ton and therefore the fuel cost per thousand cubic feet of gas made. providing the increase in pounds made was not too great. Sufficient data was obtained to lead the company to believe this would not be the case.

After considerable investigation of various types of producers, it was decided to install high-pressure producers which would gasify at least one-half braize and one-half small or nut coke.

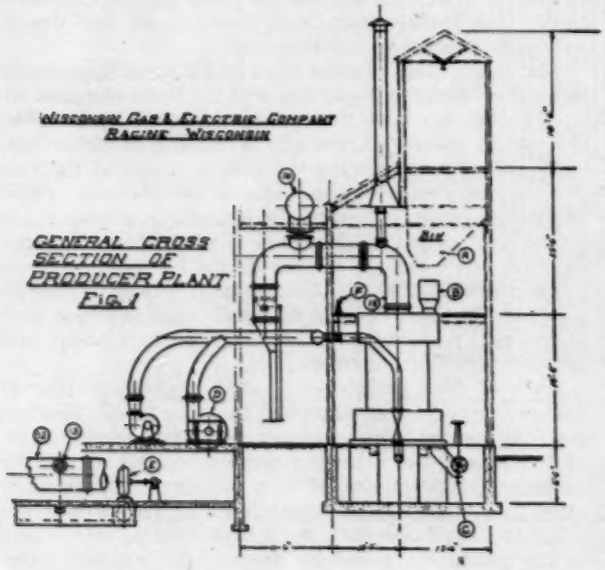
Each of these producers is rated to gasify 25 tons of fuel per day. It was estimated that one of our benches could be heated with producer gas made from 360 lb. of braize and nut coke per ton carbonized, or all the benches would require 56 tons per day. This was so close to the capacity of two producers that it was decided to install only two, until such time as our beliefs in the producers could be thoroughly justified, after

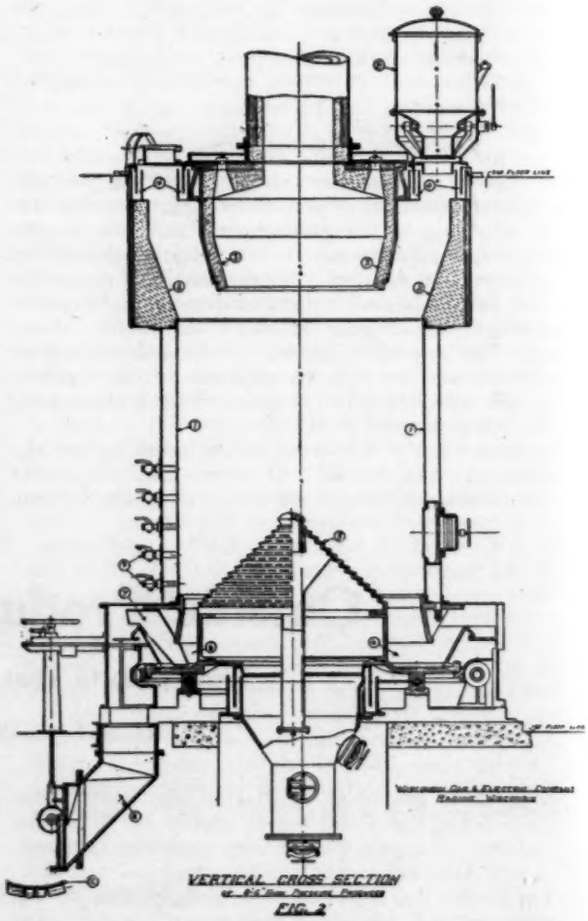
which a spare producer could be added. As we could not afford to put ourselves in the position where we had no spare equipment, it was decided to put in a 9-ft. water-gas machine to be run for blue-water gas and make sufficient gas to replace a producer when necessary. We could also make sufficient carbureted water gas to supply two-thirds of our output in case of coal shortage, labor troubles or when advisable to make water gas from a cost standpoint. Further, it would not be a lost investment, as in the case of a spare producer, should the producer plant fail to do the work contemplated.

Description of Plant

The producer plant consists of two producers and auxiliaries. These are installed in a well-ventilated steel and brick building at one end of the retort house. Above each producer is a concrete fuel bin A (Fig. 1) having 35 tons capacity, or about thirty hours' supply. The coke is carried from the screening plant by motor trucks and dumped into a pit at one end of the producer plant. A monorail crane with a 1-yd. grab bucket hoists the coke from this pit to the overhead bins. From the bins the coke discharges by gravity into a hopper B mounted on the top of the producer. This hopper has a cover which can be clamped on and a cut-off gate at the bottom to discharge the fuel, allowing the fuel to be charged without the escape of gas from the producer. The hopper is rotated by man-power to distribute the fuel around the circular magazine. The ashes are discharged intermittently from the bottom of the producer onto a belt conveyor C and carried to an outside pit. From here they are hoisted by the monorail crane into an ash bin inside the building, from which they are loaded into trucks or wagons and sold.

Each producer consists of a water-jacketed steel shell 1 (Fig. 2). Above this shell is a fire-brick lining 2, inside of which is a smaller thimble of fire brick extending down from the top 3. The space between these serves as a magazine from which the fuel is continuously fed onto the fire bed. The top of the producer revolves



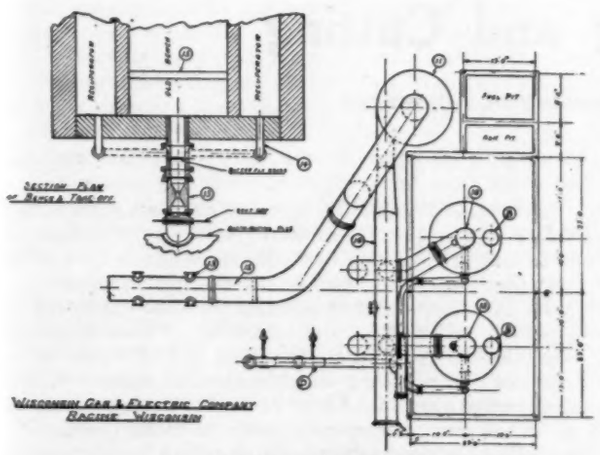


in two circular concentric water seals 4, between which is set the coke-charging hopper B. At the bottom of the steel shell is a conical step grade 5 which is set eccentrically with the shell and is rotated by means of a variable speed motor. As the grate revolves, the ashes fall into a trough 6 around the grate, from which they are picked up by a plow and dropped into a hopper 8 at the side. The height of the ashes in the shell can be determined through five sight-cocks 9 located on opposite sides of the shell.

The gas leaves the top of the producer through a 5-in. flue 10 (Fig. 3) to a cyclone dust arrester 11, and from here passes to a flue 12 running the entire length of the retort-house basement. The dust arrester and flues are insulated with 4½ in. of sil-o-cel brick, inside of which is a 4½ in. fire-brick lining. From the gas flue an offtake containing a Venturi meter and damper leads to each bench 13. Secondary air is supplied by an 8,000 cu. ft. per minute fan E at 6 in. pressure through a 24-in. concrete pipe beneath the floor, directly below the gas main. Four-inch offtakes lead to each bench 14 (Fig. 4), through fhich the amount of air is controlled by a damper and orifice meter. The gas is fed directly into the old fire box, the only change necessary being the erection of a baffle plate 15 before the inlet to reduce the velocity head of the entering gas and produce a uniform distribution through the bench.

Operation of Plant

Air from the producer is blown from an 8,000 cu. ft. per minute blower D at 26 in. pressure in beneath the grate and mixed with a definite amount of moisture in the form of steam. The amount of steam is regulated so as to maintain a fixed CO_2 content in the gas. This steam serves to form part of the gas and prevents the formation of large clinkers. The CO_2 content is carried as low as possible without getting into clinker troubles, and average about 8 per cent. The amount of gas produced is determined by the quantity of air supplied to the producer, the air being controlled by a hand-operated gate F (Fig. 1) and a Venturi meter. The gas leaves the producer at a temperature ranging from 1,000 to 1,200 deg. Fahr. and enters the benches at approximately 1,000 deg. The heating value of the gas ranges from 125 to 135 B.t.u. per cubic foot, depending on the composition of the coke.



PLAN OF PRODUCER PLANT & DISTRIBUTING FLUE
FIG. 3

The average gas shows the following analysis:

CO	24
CO_2	8
O	0
H	13
CH_4	1
N	54

It must be remembered that this installation is an innovation so far as using producer gas to heat a type of bench such as we have at Racine, and the company had no past experience to rely on.

There were three plants in America that had used outside producers with little success, and we were advised by these companies to go very slow with producers. The officers of the company, however, had sufficient confidence to take the initiative in the proposition and provided the funds to go ahead.

The following results show how well this confidence was fulfilled:

Labor Saving

Prior to producer installation there were sixty-eight men working on the three shifts in the retort house. This number included foreman, conveyor men and all other workmen that were necessary to operate the retort house from coal in the bunkers to coke screened and in the bins and ashes to the ash pile. These men were paid an average of $6 per day each, or a total of $408 per day, so that our retort-house labor per thousand cubic feet made was around 14 cents. Since installing producers the labor has been reduced to thirty men, including the producer-house operators, a reduction of thirty-eight men at a minimum wage of $6 per day of eight hours, or $228 per day. There is no doubt that six or eight men would have been taken out of the house without the producers, due to changing labor conditions. However, a net saving in labor due to producers is over $150 per day.

Fuel Saving

It is not known just what the bench fuel per ton of coal was on the individual furnaces, as coke was run direct from the retorts to the furnaces without weighing. Various tests showed approximately 325 pounds per ton, using the best grade of coke we made. We are now weighing by truckload all fuel that goes to the producers, and show about 360 pounds of dry fuel per ton of coal carbonized. These two figures will be used for comparison of fuel costs.

An analysis of coke values during the time the producers have been in operation shows that screened coke has had a net sale value of at least $3 per ton above pea coke and braize.

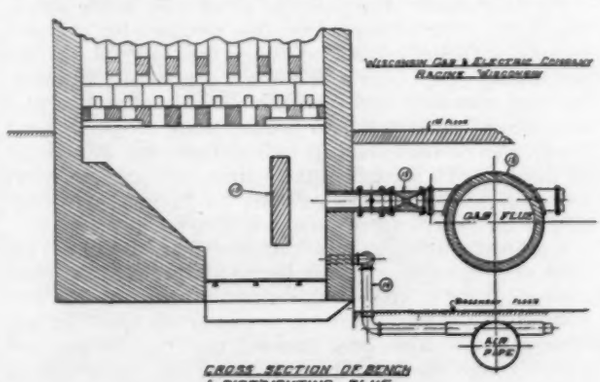
The average producer fuel sizes by weekly samples has been:

Through	¾-in. screen—Braize	46.5 per cent
Through	1¼-in. screen—Pea	24.5 per cent
Over	1¼-in. screen—Range	29.0 per cent

The average analysis is:

Vol. matter	5.9%	Dry basis
Fixed carbon	75.0	
Ash	18.0%	
Sulphur	1.1	
B.t.u.	11890	

From the above percentages of sizes and differential value some idea can be gained of the savings in fuel costs per ton of coal carbonized. Racine will carbonize on full operation about 9,000 tons per mounth, so that



CROSS SECTION OF BENCH & DISTRIBUTING FLUE
FIG. 4

it requires no mathematician to determine that the savings will pay dividends on a capital of approximately one quarter of a million dollars.

It is sufficient to say, in conclusion, that the results obtained to date have proved the company's faith in the installation. There is one point, however, that has not been attained. We had estimated that a temperature of 2,600 deg. in the combustion chamber would be attained as against an average 2,200 with individual furnaces. To date we have reached 2,400 at times, but average 2,250 to 2,300 deg. We have hopes of raising this by increasing the recuperator area when the benches are refilled. Our present recuperators are of the straight-pass type and were designed to give a large furnace area rather than recuperator area.

We realize that there are very few plants that can make the savings that our plant has been able to attain, and do not wish to lead the readers to believe we are recommending the producers for all coal-gas plants.

In order to further increase the efficiency of the plant we have recently let contracts for five waste-heat boilers to be operated in connection with the benches and from which we expect to obtain a net minimum of 150 h.p.

We are also installing scrubber stand pipes and governors. During the investigation of these governors one was installed on a stack of five benches. The seal was lowered to approximately two-tenths of an inch and it was found that the vacuum on the hydraulic main could be maintained within ½ mm., the pressures being determined by a very accurate instrument. After these governors are installed we contemplate running without seal.

Gas Welding and Cutting

Rules for Safe Handling of Apparatus

To understand the hazards, and precautions to be taken in the safe handling of gas welding and cutting apparatus, it seems advisable to consider briefly the principal characteristics of the materials used.

Electrolytic oxygen is prepared by passing an electric current through water in a vessel called a cell. The cell is so arranged that the oxygen is kept separate from the hydrogen. Liquid air oxygen is made by compressing atmospheric air until it liquefies. The nitrogen contained is then allowed to evaporate, leaving the free oxygen. This gas may also be produced by several chemical methods but they are too costly for commercial use. Oxygen is furnished in steel cylinders under a pressure of about 2,000 lb. per square inch.

Pure oxygen will not burn nor explode; it helps other substances to burn and, with hydrogen, acetylene, and other combustible gases, it forms an explosive mixture. Disastrous explosions have occurred when oxygen has not been properly separated from hydrogen during manufacture, or when other combustible gases have become mixed with it. To be assured of the proper purity of oxygen, it is advisable to buy only of reputable dealers who are known to market a pure product.

Hydrogen for blowpipe use is usually made simultaneously with oxygen by the electrolytic process, being carefully separated from the oxygen by the producing cell. There are other processes of manufacture, but they are generally employed in the production of hydrogen for other than blowpipe use. Hydrogen is furnished in cylinders under a pressure of about 1,800 lb. per square inch. It ignites when in contact with a spark or open flame and, with oxygen or air, forms an explosive mixture.

Carbohydrogen gas is composed of about 83 per cent of hydrogen, the rest being mainly hydrocarbon gases. It is stored in cylinders containing 100 and 200 cu. ft. of gas, under a pressure of 1,800 lb. per square inch. Blau gas, thermoline, Pintsch gas and other gases used with oxygen in the blowpipe or torch are very combustible, hence are easily ignited, and with oxygen or air may form an explosive mixture.

Acetylene is made by treating calcium carbide with water in a properly designed generator. Calcium carbide is a gray crystalline substance made by melting together lime and coke in an electric furnace. Calcium carbide is neither inflammable nor explosive. It is stored and sold in cans or drums. These drums are sometimes damaged in handling and if water comes into contact with the carbide there is danger of ignition and explosion. Theer is also danger from sparks if the drums are opened with a metal tool. If a metal tool is used to open the drums, a wooden mallet and not an iron hammer should be employed. Carbide drums should be stored in a well-ventilated dry place.

Acetylene (C_2H_2) consists of approximately 93 per cent by weight of carbon and 8 per cent by weight of hydrogen in combination. It is one of the few endothermic gases, that is, gives up heat when it splits up into its constituents—carbon and hydrogen—in the welding flame, thus adding to the heat produced in combustion. This gas is capable of producing a higher flame temperature (approximately 6,000 deg. Fahr.) than any other known gas. Acetylene, like other combustible gases, ignites readily and also forms an explosive mixture with air or oxygen.

Acetylene should never be used at a pressure exceeding fifteen pounds per square inch, as above that pressuree it is liable to dissociate and explode if subjected to heat or shock. It may, however, be safely stored at pressures exceeding fifteen pounds per square inch if compressed into an approved cylinder containing a porous substance saturated with a liquid solvent.

Acetylene Generators

These are of three types, known as "carbide to water," "water to carbide" and "displacement" generators. In the first the carbide is placed in a hopper

in the upper part of the generator from which it is gradually fed into the water in the lower part. In the water to carbide type of generator a regulated amount of water is allowed to flow into the carbide chamber. In the displacement type, the carbide is placed in a basket or holder which is dipped at regular intervals into the water. The "carbide to water" type of generator is in general use, as by this method it is possible to produce cool, washed gas in large volume, which is essential for welding purposes.

Generators are spoken of as medium or low pressure, depending upon the pressure under which the gas is formed. A medium pressure generator is one in which the maximum pressure in the generating chamber does not exceed fifteen pounds per square inch, under any conditions. In the low-pressure type the pressure never exceeds one pound per square inch and is usually only a few ounces.

Portable generators, usually on wheeled trucks, are designed primarily for outside use, and should not be employed in shops. They should not be used within ten feet of combustible material (except the floor) and should be cleaned and recharged outside of buildings. When charged, they should not be moved by crane or derrick.

Many accidents have been caused by home-made generators, and these should not be used. It is better to pay a higher first cost and get the benefit of the experience of reliable manufacturers and trained designers. Home-made generators are not insurable and their use is a constant invitation to serious trouble. Reliable makers of generators publish rules for operating. These should be posted where they will be seen and should be rigidly followed.

The regulations of the National Boardof Fire Underwriters (1919 edition) should be followed in the installation of all generators equipment and only apparatus approved by underwriters' laboratories should be used.

Generators should be large enough to supply the torches for one-half day without recharging. They should never be located in a room where welding work is being done nor where an open flame of any sort is used. It is best to locate them in a separate fireproof building away from other shop buildings. The generator house should be well ventilated and should have enough windows to let in plenty of daylight for cleaning. Artificial light should be supplied by electric lamps located outside the house so that the light will shine through the windows, or, if inside, protected vapor-proof electric lights with control switches outside of room. During freezing weather the house should be heated by steam or hot water.

Every generator should be set on a substantial foundation to avoid strains caused by an uneven footing. Generators in which the working pressure exceeds one pound per square inch should be fitted with a regulating mechanism, pressure gauge, automatic feeding device, safety blow-off and escape pipe. The generator installation should be provided with an approved hydraulic back-pressure valve, which will prevent a back flow of oxygen or a back-fire in the piping system from reaching the generator.

A careful, competent workman should be delegated to take charge of generators and unauthorized persons should be prohibited from entering the generator room. The workman in charge should not be permitted to carry matches. A notice, "No smoking; keep all flame and sparks away," should be conspicuously posted both inside and outside generator room.

Many accidents have happened while generators were being cleaned. This should preferably be done only by daylight. When it is necessary to do it by artificial light an incandescent lamp in a vapor-proof glove with a guard to prevent breakage should be used. Extension cords should never be used, as a spark might be caused by a defective cord. Matches or an open flame must never be used, as pockets of gas are liable to remain in the generator even after the pressure is all off the gauge. Again, small amounts of caked carbide in the generator may absorb enough moisture to generate gas and burn the workman. Friction igniters should not be carried into generator houses.

The following additional "Do's" and "Don'ts" should be observed in operating the generator:

Clean and charge at regular intervals.

Always flush out before recharging.

When recharging carbide to water generators, always keep the generating chamber filled with water to exclude air.

Don't put in any fresh carbide without renewing the water.

Don't use anything but steam or hot water to thaw frozen parts.

Don't test for leaks with an open flame. Use soapy water.

Don't leave the generator open to the air nor blow air through it.

Don't light or carry matches around the generator.

Don't smoke in the generator room.

Don't make repairs until the generator is free from gas. Flood the water chamber before repairing and make sure the generator is absolutely free from all gas and carbide.

Never leave carbide drums open while any carbide remains in them. Don't experiment.

Cylinders

Use only cylinders which comply with the specifications of the Interstate Commerce Commission and are so marked (see regulations of the Bureau of Explosives, Sept., 1918). Shipping container specification No. 3 applies to cylinders for any liquified gas whose charging pressure at 70 deg. Fahr. exceeds 300 lb. to the square inch. Specification No. 3-A applies to cylinders for non-liquefied gas whose charging pressure at 70 deg. Fahr. exceeds 300 lb. per square inch. Specification No. 8 applies to acetylene cylinders. The abbreviated marking I. C. C. No. —— is employed to signify compliance with the specifications.

Compressed gas cylinders must never be handled by an electric magnet. When cylinders must be handled by a crane or derrick, as may be necessary on construction work and in shipyards, they should be carried in a cradle rather than a sling, and extreme care should be exercised that they are not dropped.

Empty cylinders should be plainly marked "Empty," with valves closed and sent to storeroom. They should be returned to the manufacturer as soon as practicable.

Acetylene Cylinders

Acetylene may be purchased in cylinders supplied to the trade in sizes containing up to 500 cu. ft. of dissolved acetylene under maximum pressure of 250 lb. at deg. Fahr. To store acetylene safety the cylinders are packed with some porous material like asbestos, which is then soaked with a liquid solvent such as acetone. Acetylene gas is then forced into the cylinder where it is absorbed by the acetone. The solution of acetylene in acetone is non-explosive even under high pressure. Therefore, when put up in this way the gas is safe. The porous filling in the cylinder leaves no space to be occupied by "free" compressed acetylene gas. The gas all remains in solution in the acetone soaked filling.

Acetylene cylinders should be handled carefully, as should other high-pressure containers. Knocks, falls or rough handling are liable to damage the cylinder, valve or fuse plugs, and cause leakage, and may even result in an explosion. The cylinders (unless empty) should always be stored and used in an upright position; if allowed to lie on their sides, the acetone may leak out with escaping gas. This would cause improper working of the regulators. The use of racks for storing cylinders, and of trucks for holding them in upright position while in use, are shown on pages 6 and 7.

Acetylene cylinders should be stored in a safe, dry, well ventilated place where they will not be unduly exposed to the heat of stoves, radiators, furnaces, or the direct rays of the sun. Heat will increase the pressure, or it may melt the fusible safety plug with which all cylinders should be provided and which melts at a temperature of approximately 212 to 220 deg. Fahr.

Every precaution should be taken to prevent leaks of gas at connections made to the cylinder valves. If a leak is discovered at a connection, always shut off the cylinder valve before tightening connection. See that gas is not leaking around cylinder valve stem; if there is a leak at this point, tighten the stuffing nut. In case of a leak developing in the cylinder, place the cylinder in the open where the gas cannot escape into a confined space. Do not attempt to repair cylinder, but notify the filling station and in any case drain the cylinder of gas before shipping.

Under no circumstances attempt to transfer acetylene from one cylinder to another and never under any conditions attempt to compress acetylene into a cylinder. This work should only be performed by acetylene charging plants and under conditions which comply with Interstate Commerce Commission regulations.

When welding or cutting is being performed in a confined space, such as the interior of a boiler, always leave the cylinders on the outside with an attendant and lead the gas in, through hose, to point where work is being done. Fire-resisting hose is advisable for such work.

Leaks can usually be detected by the odor of the acetylene gas and their location can be determined by putting soapy water on the fittings and watching for bubbles. Never test for leaks with matches or an open flame of any sort.

Acetylene acts on pure copper producing under some conditions an explosive compound. For this reason no copper fittings should be used on acetylene tanks. Brass or bronze may be safely used.

Oxygen Cylinders

Oxygen is supplied to the trade in cylinders of various sizes up to 250 c. ft. of gas under a pressure of from 1,800 to 2,200 lb. per square inch. The outlet valve is protected by a cap which when the cylinder is not in use should always be in place, screwed down against boss plate to present injury to the threads and plate.

Oxygen cylinders should be handled carefully, should never be dropped, and should be placed so they will not fall nor be struck by other objects. The principal hazards in the use of oxygen cylinders are caused by tampering with the fittings, and the use of grease or oil on the apparatus.

The discharge valve should be opened slowly when the cylinders are first put into use. If the high pressure is suddenly released it is liable to damage the regulator and pressure gauges, which should always be employed when oxygen is discharged from a cylinder. A hammer should never be used for opening the discharge valves.

Oxygen cylinders should not be stored near acetylene cylinders because of the possibility of leaks developing in acetylene cylinders with resulting possible ignition.

Where only one torch is used, the cylinders containing oxygen and the combustible gas may be conveniently mounted together on a truck. They may then be easily moved about and are also less liable to injury. In large installations the cylinders may be stored upright in a battery, with their discharge valves connected by a manifold. Manifolds should be made of double extra heavy piping not exceeding 1¼-in. pipe size and should be short as practicable. From the manifold the gas is passed through a master regulator to various welding stations. Service regulators for both the oxygen and acetylene should be provided whenever gas is drawn from manifold supply lines. The regulations of the National Board of Fire Underwriters should be followed in making manifold connections.

When shops are piped for oxygen, care should be taken that the pipe lines are free from rust and that no grease, white lead or similar substances are used in the pipe joints. Copper pipes must not be used for acetylene.

Regulators or Reducing Valves

Regulators or reducing valves must be used on both the oxygen and the combustible gas cylinders to reduce the pressure and maintain a constant or even pressure of gas for the torches. All pressure regulators should be equipped with safety relief valves or be so designed that, should the diaphragm rupture, broken parts will not fly. Workmen should not stand in front of regulators when making adjustments, but always at the side.

It is recommended that only regulators which bear the approval of underwriters' laboratories be

(*Continued on page* 336.)

As the Journal Views It

An Important Contribution

Thomson King, in his article which leads this week's issue, has brought out in concise fashion the fact that the world eventually will have to turn to gas for fuel. It is a logical conclusion that Mr. King draws and one which must have the hearty approval of all who have given this important subject any consideration.

Each form of fuel has been analyzed by Mr. King and its claimed advantages over other forms have been stated succinctly, but in the end when all of the facts are placed in the scale, the advantage of gas is clearly shown.

Not the least interesting part of the article is the brief history of the development of mankind as shown by the development of heating processes and the advance that has been made. It has been shown by the author that the part that gas has taken in this advance has been of great importance and from this point he develops the thought as to the future of our product as the fuel of the future.

It is interesting to note that Mr. King, in dealing with the future, takes up a period that all can conceive. Much that has been written dealing with the future has been vague and indefinite and many of the prophecies have accordingly been without base and ridiculous. This fault cannot be found with Mr. King's conception of what we may look forward to.

In discussing the article Mr. King made the extremely valuable suggestion that the title might well be adopted by the gas industry as a slogan. This thought has real meat, as will be admitted by the most casual, and it would be well to bear it in mind. More will be heard regarding it.

The AMERICAN GAS JOURNAL is convinced that the article by Mr. King is among the most valuable contributions to gas literature of the current year or for many years past. It undoubtedly will create a tremendous amount of discussion and the JOURNAL will gladly open its columns for such constructive thought on the subject as may be offered.

Another "Expose"

The New York *World* on April 5 started what is claimed to be an "expose" of the inefficiency of the B.t.u. standard as compared to the candle-power requirement which has been in force in New York City for many years. The entire series, which, it is promised, will go into the matter thoroughly, is based on the results of "experiments" by William R. Birdsley, chief gas examiner of the City of New York, who, the *World* naively admits, "does not pose as an 'expert' but offers to prove by actual field and laboratory experiments with standard apparatus that a 525 B.t.u. gas is from 24 to 33 per cent less effective in heating and lighting than our present 22-candle-power gas; that its use entails, therefore, an increased consumption of 30 per cent in order to overcome the difference in effectiveness."

In another part of the first article the *World* says: ". . . when the city, through Assistant Corporation Counsel Hyatt, put Mr. Birdsley on the stand at hearings before the Public Service Commission and sought to produce in evidence the tables showing the results of Birdsley's experiments there was a roar of objections from the lawyers representing the gas companies, and Chairman Prendergast finally ruled that Mr. Birdsley could not qualify as an expert because he had not been trained in any recognized scientific school or college, or taken its equivalent in outside study."

The *World* dramatically refers to the "lone part" taken by Mr. Birdsley, who is heroically facing the array of expert opinion which the Public Service Commission has heard during its investigation.

Gasmen have been heard to refer to New York City as "antique New York," and this certainly describes conditions when a newspaper as powerful as the New York *World* seeks to stir up opinion against the service rendered by gas companies under the orders of the Public Service Commission. The subject is much too technical for newspaper consumption, as we believe the *World* will learn when it has gone into the subject a little further, but it will be interesting to watch just how the matter is developed.

But there is a side-light that is not quite understood. For years the New York *Evening World*, published by the same interests as the morning paper bearing that name, has been active in gas legislation and litigation. A few months ago Sophie Irene Loeb, who has been handling this matter for the evening paper, switched from her adherence to a candle-power standard and at frequent intervals has been demanding the B.t.u. standard. We wonder just how the owners of the *World* are going to reconcile this wide difference of opinion between the two editors. Of course, it may be that no matter which way the cat jumps the owners of the *World* will claim a "moral victory" for the newspaper, but that is so contrary to the policy of the papers that we are at a loss to understand just what they are driving at.

We regret greatly that the New York *World*, which we have always admired, should have been led into this subject, for it is not going any place and it is simply

stirring up a tempest that is not going to get it any place. The B.t.u. standard is being adopted in New York City —it probably will be announced for all companies within the near future—and after a trial we are sure that the *World* will be the first to acknowledge that it has been led astray by somebody who claimed to have knowledge that he did not have. But it is all very interesting and it serves at least as a feature that will prove more entertaining to its readers than did the series that Emma Goldman started for that paper and which ended abruptly when it was found that she had left her spectacles at home and was trying to see things far away when she is nearsighted.

Gas—The Fuel of the Future

(*Continued from page* 322.)

to consider. The efficiency of the water wheel, turbine and electric generator have all been pushed to the neighborhood of 90 per cent. We have little room left for improvement here; we are already too near perfection.

The amount of the water powers capable of development, but as yet unharnessed, is known with reasonable accuracy, and the total is an imposing figure We must remember, however, that the power sites that can be most cheaply and easily developed, or which lie near our centers of population, have already been exploited.

The remaining sites will cost more and more per unit of output and, even though every practical power site that could be developed at a reasonable cost. were put to work, it would not long supply the power needs of the world. We can look for no great supply of cheap fuel from our streams and rivers: these will help greatly for power purposes, but we must find our fuel elsewhere.

Possibilities as Yet Unproved

Passing to the second group of fuel possibilities, that is, those not yet utilized to any practical extent, we must pass over atomic energy because no one in the world to-day can say with authority whether the idea that we may some day learn to employ these vast sources of energy manifested by atomic disintegration for useful work is a legitimate hope or an idle dream entirely impossible of realization.

Almost the same thing may be said of the radiant heat of the sun, except that in this case we can calculate its extent. It can be shown that a square mile of the earth's surface receives in one year assuming only six hours as the effective day, an amount of heat equal to that produced by the combustion of about a million tons of coal. The surface of the Sahara Desert receives each day solar energy equivalent to more than three times the heat contained in the world's annual coal production. We can, however, see no hope of converting this disfused energy into any form that can serve our fuel needs at reasonable cost.

Wind, Wave and Tide

The first two may be considered together as the first is the cause of the second: They can both yield power which can be transformed into heat, but both have the fatal disadvantages that they are intermittent, uncertain, subject to the widest variations in intensity and incapable of being harnessed to large units of power generating machinery, hence they can never be utilized for the steady production of large amounts of power at low cost, and we may dismiss them from our consideration as major sources.

Tide power demands more attention. In certain favorable locations, it may be developed in a large way and harnessed to large units, but it is intermittent and variable and can only be made a steady, continuous source of energy when some provision is made to store up energy when it is running full to be drawn upon when it is slack. This is possible in some cases, but it is enormously expensive. The cost per unit of power from a large tide plant must always be very high, so high as to make its use impracticable except in a few places where conditions are especially favorable, and even in such cases, the energy developed will be used for power and not for fuel.

Internal Heat of the Earth

Beneath the surface of the earth are vast stores of heat. Will we ever draw on it for our industrial needs? We know that in Italy they are driving electric generators with volcanic steam. Is this the beginning of an extensive exploitation of internal heat? We think not. Like tide power, there is nothing impossible about its use, but it can only be had cheaply in a few exceptional places, and to procure it elsewhere will always be exceedingly expensive. As far as we can see now, it can only be made available for distribution as steam or electricity and, while it is reasonable to suppose that we will learn how to do better, we cannot see how we can raise this figure above 40 per cent, even with a large increase in cost of equipment.

Mineral Fuels

In the foregoing paragraphs, we have considered many potential sources of heat, but we have so far failed to find any which in the light of our present knowledge and experience holds the hope of a great reserve of cheap fuel energy which may be cheaply applied to the needs of the future. There remains to be considered our high and low grade coals and lignites, our shale oil deposits and the oil that will not flow from our oil sands. It is to these we must look for the fuel which is to preserve and enlarge the progress of our civilization.

The coal reserves of the world are estimated at about 7,400,000 million tons, of which 5,000,000 millions tons are in North America, but a very great proportion of this is low grade (3,000,000 million tons lignite) and much of it both low and high grade would be very costly to mine. In any estimate of the coal available for our future use, it will be best to take half of the figures just given. Assuming an annual world consumption of two billion tons when normal commercial conditions are restored, gives us an apparent supply for 1,850 years. A period that, if it could be relied upon, would be sufficiently remote to preclude anxiety on our part to-day and remove speculation from the realm of practical usefulness,

but there are very important factors that must be considered. The consumption of fuel must rise with the spread of our industrial civilization and the increase of population, and as the high-grade coals are exhausted, it will take more and more of the low-grade varieties to produce equivalent results.

There is an economic law known as the law of diminishing returns. This law affects all production and is always at work. It applies with especial force to the production of fuel, as we know it to-day. The law states that beyond a certain point every increase in production is obtained at the expense of a more than proportionate expenditure of capital and labor expended in production. This law operates effectively in the mining of fuel.

Conditions That Will Govern the Future

To summarize what we have said in the preceding paragraphs, we are faced in the comparatively near future with the exhaustion of our oil and natural gas supplies on which we have drawn so extensively in recent years. At the same time, we must face a steadily increasing cost of obtaining high-grade coals. Examination of all other possible major sources of fuel supply has failed to disclose any that offers a great world supply of fuel at a reasonable cost, with the exception of our coal reserves, our immense deposits of oil shales and possibly the petroleum that still remains in our oil sands. It is on these that we must depend.

Acknowledging these facts to be inevitable and unescapable, and that they must be met and dealt with in a comparatively short time, it behooves us to ask ourselves how they will affect our economic life and our methods of handling and supplying fuel.

It is at once evident that when dealing with low-grade fuels, it is uneconomical to attempt to transport them in their natural state to the point of use. The lower the grade of fuel—that is, the less heat units it contains per unit of weight—the shorter the distance that we can transport it in bulk. It will be inconvenient and in many cases impracticable to transport our industries and our population to the neighborhood of our fuel deposits. The populations will stay largely where they are at present, in those locations most favorable to general living conditions, transportation and commerce. We must, therefore, bring the fuel to the population, and we have already pointed out that we cannot bring a low-grade fuel long distances in its natural form.

This is the first great consideration, and the second is like unto it.

We cannot obtain efficiency, convenience, flexibility nor cleanliness from the utilization of fuel in solid or liquid form. Such forms are not ready for combustion. The future demands a more ideal fuel form than the past. Heat processes are becoming more and more exacting in their requirements and cannot be met and satisfied except by a flexible, easily controlled fuel, in a form ready for immediate application, and which leaves no troublesome residue.

To sum up in a few words: We cannot continue to handle, transport, transfer and deliver solid fuels of steadily decreasing calorific value; furthermore, we must gradually eliminate the use of solid and liquid fuel forms, if the advance in efficiency, comfort and convenience of our modern civilization and industry is to continue. The future will demand that crude fuels be converted into more perfect forms of heat energy before being delivered to the ultimate consumer, and in the case of low-grade fuels, before transportation is attempted.

Many years ago, Siemens made the statement that the burning of coal in its crude state was barbarous. This is doubly true to-day. The transportation and delivery of coal through our city streets, the disposal of ashes, the low efficiency of application, and the tremendous loss due to smoke damage to both health and property is too great a handicap to be tolerated much longer.

Gas Versus Electricity

At present we know of only two forms in which heat energy can be economically transmitted long distances. They are, of course, gas and electricity. These two forms also meet the specifications of the ideal fuel, for they are ready for immediate application, clean, flexible, easily controlled and efficient. Which is destined to become the dominant form in our homes and factories?

We can see that this momentous question will be decided by three factors. First, the relative cost and efficiency of the processes by which the crude fuel is converted into gas or electricity; second, the relative cost and efficiency of transmission and distribution by the two forms; third, the relative cost and efficiency of utilization. The net result of these three factors will be the overall efficiency of transmitting heat units from crude fuel to finished work. On this net result, the ultimate choice of fuel form must be made.

Beginning with the first of these, that is the generation of gas or electricity from the primary fuel, we can safely assert that the modern gas plant can by complete gasification of coal and recovery of by-products, make available for useful work more than three times as great a proportion of heat units in the fuel as the modern steam turbine electric generating station, and that while neither of these processes has been developed to the maximum efficiency attainable there is no valid reason to suppose that the future improvement in electric generation will be greater than in gasification.

In fact, the prospects for great improvement and cheapening of the process of generation are much better for gas than electricity. There is some reason to believe that we will soon be able to produce oxygen very cheaply. If this hope is realized it will probably mean a revolution in our methods of making gas which will give us cheaper and better gas than we can produce to-day and will open vast new fields for its application.

Next, with regard to the relative cost of the two processes. The cost of the gasification plant will not be greater per million B.t.u. recovered than the electric; in fact, we have every reason to believe that future developments will make it considerably less.

Passing to the second division, the partisans of electricity will immediately present its claims based upon the ease and cheapness with which it can be transmitted and distributed. But is this claim sound?

It has been a serious fault of the gas industry that it has allowed many of the claims of electricity to pass unchallenged, tacitly admitting soundness where no

soundness existed, if it had realized the possibilities of its own fuel. In general, we can assert to-day that gas can be transmitted and distributed more cheaply per million B.t.u. than electricity. There is nothing impossible or theoretical about this assertion. An analysis of fixed and operating costs under like conditions will prove it in every case. Even for long distance transmission, natural gas is transmitted more cheaply per million heat units contained than high-tension electric power.

Passing to the last factor, the electric partisan again presents a claim based upon higher efficiency of utilization. This, however, is only one part of the overall efficiency from primary fuel to finished work, which will be the ultimate deciding factor in fuel selection. In most cases where this true efficiency is considered, gas is by far the more efficient fuel. Let us illustrate what we mean by two specific cases.

Let us take a process such as the heat treating of steel parts. Let us credit a given electric furnace with a 70 per cent efficiency. The best electric plant and distributing system can only deliver to the terminals of the electric furnace 15 per cent of the heat energy contained in the coal. We, therefore, have an overall efficiency from coal to work of 10.5 per cent. A modern gas plant, however, by completely gasifying the coal can recover in useful form 75 per cent of the heat units in the coal. Assuming an efficiency of only 20 per cent for a competitive gas furnace, the overall efficiency of the gas process is 15 per cent, and by the use of a recuperator or a regenerator upon our furnace, we could raise this to 18.75 per cent from coal to work.

In the foregoing illustration, we have taken a high temperature process which can be carried out in a closed electric furnace; that is, a process exceptionally favorable to electric efficiency in comparison with gas. Suppose, however, we take the case of some low-temperature heat process requiring ventilation such as the baking of bread or a japanning oven. We will in this case credit the electric oven with an efficiency of 75 per cent and the gas oven with an efficiency of 60 per cent. Taking the same efficiencies of generation as in the first illustration, we have an overall efficiency of 11.25 per cent for electricity and 45 per cent for gas. These relative efficiencies are in no way exaggerated and they mean that, except for very high-temperature processes, or processes in which it has some special advantage, or for those parts of the country where cheap electricity is available on account of abundant water power, that electricity cannot compete for the work of our domestic or commercial heat processes with gas.

If we examine the relative overall efficiencies of the two as applied to the production of power, we find a different story. Using the same efficiencies of generation and transmission as in the foregoing examples, and crediting the gas engine with an average efficiency of 20 per cent and the electric motor with 80, we arrive at an overall efficiency of 15 per cent for gas and 12 per cent for electricity. Since we must admit greater flexibility and ease of control to the motor as a source of power, we must concede this field to electricity.

As time goes by, and as fuel conservation becomes more important, every form of heat energy will acquire those processes to which it can prove its right by virtue of economy or special convenience, and will resign to the other, those processes to which it cannot show a fair claim.

It will be extremely wasteful of the time and energy of either industry to endeavor to hold by force any process to which the other may show the better claim. For the gas industry to endeavor to hold general lighting, power and small portable household appliances where the cost is small in comparison with the convenience and safety of electric appliances, is wrong and wasteful. On the other hand, for the electric industry to seek to acquire and exploit the electric japanning oven, the tempering furnace, the hotel range, the bake oven and many other appliances, is equally wrong and wasteful.

The two must divide the field, and each take those applications to which it is entitled by virtue of the highest overall efficiency and consequent economy. On this basis, to gas will fall practically all large and medium commercial heat processes that are carried on at low and medium temperatures, and all domestic heating, cooking and water heating, with the exception of small portable appliances. In short, the vast bulk of the heating load of every community.

To electricity will go the very high-temperature commercial processes, the power and most of the lighting load, the smaller domestic appliances and, in some thinly settled parts of the country where water power is abundant, the whole domestic load. Such must be the ultimate division, and it will be the part of wisdom for all parties concerned to accelerate rather than retard the inevitable adjustment and division along these lines.

The Present and Near Future

To realize such a fair and equitable division of processes on the basis of right, not grace, one condition is necessary. This essential condition is equal aggressiveness in the pursuit of business and equal skill in the operation of their properties by the gas and electric interests.

In the past this has not been the case. In general, the electric interests have been the more aggressive in the pursuit of business. This applies to both the operators of central station companies and the manufacturers of appliances.

The great number of electric japanning ovens in use to-day is a monument to the enterprise of the electric industry and gas apathy to the exploitation of commercial business. The general use of differential rates to secure the large commercial load by the electric industry and their absence from the gas industry is but another manifestation of the same tendency.

Let us illustrate what this lack of differential rates means. A large electric central station finds the switchboard cost of its power to be 24 cents per 100,000 of B.t.u. contained. A corresponding gas generating plant finds its holder cost to be 7 cents per 100,000 B.t.u. The cost of delivery to a large industrial customer with a good load factor is about the same per 100,000 B.t.u. for gas and electricity. The electric company will probably make a rate to such a customer corresponding to, say, 48 cents per 100,000 B.t.u., which is double switchboard cost, but in most cases the gas company will not consider the corresponding rate of 14 cents for the 100,000 B.t.u.

Tremendous misapplications of fuel exist to-day. The supply and the price of fuels have fluctuated

rapidly; new developments and improvements in applications and appliances have followed each other with bewildering rapidity and the whole art has been and still is in a more or less fluid state, but as knowledge increases and fuel prices rise, the industries will see a crystallization of ideas and a standardization of practice, and each industry and locality will turn to the fuel form that is inherently the most efficient for its needs and conditions.

As this process of the survival of the fittest develops the considerations we have already endeavored to indicate will inevitably make gas the chosen form for most of our commercial and domestic work. What kind of gas will it be? How will it be made and supplied? These are the questions of absorbing interest. They cannot be answered except in the broadest terms, but some facts can be clearly discerned and these are of the greatest practical importance.

The gas will ultimately be supplied from great central systems of generation and distribution, but whether this will be the case in the immediate future depends upon the gas companies. If they fail to supply the large commercial and industrial users at reasonably low rates and to aggressively seek their business, such users must turn to the isolated gas plant and to electricity. This movement has already assumed large proportions. The producer plant, the blue water gas plant and modifications of the two will become firmly established. There are many such plants to-day; they will increase and multiply tomorrow.

If the central gas companies fail to meet the demand, they will be left with the small business and the isolated plants will take the larger and more desirable loads. The electric companies, always eager and aggressive, will also take large blocks of heating load that by right belong to gas. Will the gas industry allow its tremendous share of the larger heating loads to go by default?

The consequences of such actions by the central gas companies would be most unfortunate for all concerned, both they and those who install the isolated plants and the general public suffer. Gas can be more economically supplied by the great central company, but if that agency fails, and an isolated plant is once installed, its owner is not willing to scrap it, even if the gas company later offers him gas at an attractive rate. Whenever the gas company fails to supply and an isolated plant goes in, capital is invested which should have gone into the central plant and distribution system. Fuel, labor and energy are wasted and dissipated instead of being conserved and concentrated. This is doubly apparent, since, in the long run, the isolated plant cannot survive; in the end we must come to centralized production and distribution of most of our fuel energy, just as surely as we are coming to centralized power production and distribution. If eventually, why not now? We are talking of super-power systems; some day we will be talking of super-gas fuel systems.

Every isolated gas plant that is built and every unjustified application of electricity to heat processes where gas from a central plant is available, is a step in the wrong direction, a perversion of progress and an indefensible economic waste.

The issue and the opportunity are before the gas industry; difficulties lie in the way; we are hampered by obsolete standards; unwise regulation, political interference and crushing taxations, but the difficulties are not insurmountable. Some companies are seeking earnestly and effectively to overcome them and are succeeding.

So much for the time just ahead of us; what of the more distant days to come? We are still building carbureted water gas plants to-day, but we will not continue to do so much longer as the days of cheap oil are limited. By-product ovens and complete gasification of coal are steadily gaining in importance. We have not begun to send manufactured gas long distances as yet, but this will come in due time. At present, the transmission of manufactured gas for, say, 200 miles would present no great difficulties, for we are doing it with natural gas. We will do it as soon as the saving in transportation costs on raw fuel justifies it. We will not want to transmit a lean gas and we will consequently seek to produce a gas of fairly high calorific power and balance the cost of manufacture against that of transmission and distribution.

As time goes by, we will see more and more of this long-distance transmission. As our easily obtained coal is exhausted, and we begin to develop the low-grade coals and lignites, and are forced to turn to our oil shales and oil sands, we must resort to longer lines, for the gas plant will move towards the fuel supply. These oil shale and sand deposits are of such immense proportions that they seem almost inexhaustible and they must play a very great part in our economic life. It is evident that we cannot transport such material in the raw form. They must be treated on the spot and will yield liquid fuel for our automotive engines and gas for transmission to the centers of population.

Conclusion

In this article, we have endeavored to deal with the near future which can be plainly discerned, and the more distant time which must be dealt with in more general terms. The latter is interesting, but the former is of vital importance and demands immediate action. The sooner the whole gas industry realizes that gas is the fuel of the future, and shapes its endeavor in accordance with that realization, the better it will be for the industry and for the whole world.

Control of Gas Pressures by Distant Indication

(*Continued from page 325.*)

recorder shows the continuous pressure within the pipe for the given period of the chart.

Pressure Change Immediately Recorded

As the action of the meter depends only upon the level of the confined body of mercury, unrestricted by floats and mechanism, consequently the slightest change of pressure within the pipe will make an immediate change in the level of the mercury column, resulting in an immediate change in the readings of the electrical instruments. A safety seal on the meter body provides an automatic release of pressure which prevents the derangement of the elements in the meter should sudden pressure surges occur in the line.

By employing an electric current to transmit the ac-

tion of the meter to the registering instruments, all uncertain mechanical appliances, such as floats, cams, levers, gears and stuffing boxes, are avoided. There are no moving parts in the meter body to impede its action. Due to the electrical principle of operation, the instruments for indicating and recording the pressure can be arranged to conform with every variation of plant condition. They can be either separated, combined or duplicated, and can be placed at any desired distance from the measured line and at any point however remote from the meter body.

The fundamental principles involved in the Republic meter are demonstrated diagrammatically in the accompanying figure. The "U" tube partly filled with mercury is made to balance the pressure of the gas by the rise of mercury in the low-pressure side of the tube. The mercury column also forms a part of the electric circuit as shown in the figure. This electric circuit contains a fixed external resistance R_1 in series with a variable internal resistance R_2, a constant electromotive force E and an ammeter A. In the contact chamber C, which forms the low-pressure side of the "U" tube, there are a number of conductors of varying lengths placed above the mercury column, and as the mercury rises it makes contact with one conductor after another. The variable resistance R_2 is subdivided by these conductors into resistance steps corresponding to the varying lengths of the conductors, so that the rise and fall of the mercury column varies the amount of resistance and thereby regulates the amount of current passing through the circuit.

Gas Welding and Cutting

(*Continued from page* 330.)

used on cylinders of compressed gas; and it is advisable that each regulator (oxygen and combustible gas) be equipped with both a high (contents) and a low (working) pressure gauge.

High pressure gauges should be provided with safety vent covers to protect the operator from broken glass in case of an internal explosion. All oxygen gauges should be marked "Oxygen—use no oil."

Fatal and serious accidents have resulted when oxygen regulators have been attached to cylinders containing the combustible gas, or vice versa. To guard against such occurrence it has been customary to make connections for oxygen regulators with right-hand threads, and those for the combustble gas with left-hand threads, and also to paint the regulators different colors for the purpose of distinguishment. Regardless of these precautions, there have been recent accidents due to connections being made to the wrong cylinders; sometimes the right-hand thread was forced over a left-hand thread by mistake.

This hazard demands further consideration from all parties concerned. The following safeguards have been used or suggested:

Use different size fittings for oxygen and for the combustible gas.

Use a female thread on the combustible gas cylinder fittings.

Use different standard colors for cylinders, regulators, hose and other fittings.

It is hoped that the efforts of the Bureau of Standards now under way will soon result in the adoption of uniform safe methods which will eliminate this hazard.

The regulator is a delicate piece of apparatus and should be handled carefully. It should not be dropped nor pounded. Regulators should not be repaired or tested except by skilled workmen; it is advisable to send them to the manufacturer for repairs. Leaky or creeping regulators are a source of danger and should be withdrawn from service.

When regulators are not in use, the pressure-adjusting device should always be released. Oxygen cylinder valves must never be opened until the pressure-adjusting device on the regulator is fully released.

Oxygen under pressure forms an explosive mixture with oil or grease and a serious explosion may result. No oil or grease of other lubricant of any kind should be used to lubricate a regulator or to test the gauges. Neither should they be handled with greasy hand or gloves. Fatal explosions have resulted from this cause.

The following procedure should be followed in detail when attaching regulators or reducing valves to any gas cylinders:

Open the discharge valve on the cylinder slightly for an instant and then close it (generally termed cracking). This is to blow out of the valve any dust or dirt that otherwise might enter the regulator. Before opening discharge valve on combustible gas cylinders, see that no open flame or other source of ignition is near, otherwise the gas may ignite at the valve and cause trouble.

Connect the regulator to the outlet valve on the cylinder. Be careful to observe whether the connection has left or right hand thread. Never connect an oxygen regulator to a cylinder containing combustible gas or vice versa. This is highly important.

Release the pressure-adjusting screw of the regulator to its limit.

Open outlet needle valve, if one is attached to the regulator. If there is no outlet valve open valve on blowpipe.

Open the discharge valve on the cylinder very slowly. In the case of oxygen cylinders gradually open the cylinder valve to its full limit, but in the case of acetylene cylinders only open the valve and one-half turns of the valve spindle. When you open the discharge valve, stand to one side of regulator, never in front of or back of it.

Close outlet needle valve and screw in the adjusting screw on the regulator until the pressure shows about ten pounds on the low-pressure (working) gauge.

Note if the regulator creeps. Creeping will be indicated by the reading on the low-pressure (working) gauge increasing. If there is a creep have the regulator repaired.

Before releasing the pressure-adjusting screw on the regulator (except for working adjustment) always first close the cylinder valve and drain the regulator of gas.

Adjust the regulators until the required working pressure is indicated on the low-pressure (working) gauges.

Open the outlet needle valves on the regulators (if provided) and next open the needle valves on the

blowpipes and the light-up according to the procedure described in the instructions that are provided with welding apparatus.

Hose

The oxygen acetylene hose should be of different color or the couplings should be stamped for identification to avoid getting the hose interchanged. Black rubber hose is now ordinarily used for acetylene and red for oxygen. They are attached to the outlet of the regulator at one end and to the welding torch at the other. A suitable clamp and fitting, not requiring the use of a gasket, should be used for making the connections to the torch and the regulator. It is important that these connections be tight.

Long lengths of rubber hose should be avoided. When they must be used, care should be taken that hose does not become kinked or tangled, and that it is protected from being run over by trucks, stepped on, or otherwise damaged.

It is advisable where possible that metal piping be run to a point as near the torches as possible. The piping should be painted a distinctive color so that pipe fitters will not mistake it for other lines. Copper pipes must not be used for acetylene.

All joints and connections in pipe lines for oxygen should be made by well-fitted threads using a small amount of litharge and glycerine, or by threading and soldering, brazing or welding. No white lead, grease nor other pipe-fitting compounds should be used for making tight joints.

Leaks should be repaired at once, as they not only waste gas but are a source of danger. Gas escaping from defective hose is liable to become ignited and start a serious fire, and also may set fire to the operator's clothing, and cause severe burns. Valves should be closed immediately when the gas is not being used. Serious fires have happened by leaving them open.

All hose should be examined periodically, at least once every week, for leaks, worn places, loose connections, etc. It is good practice, about every two months, to cut off the hose at each end about two inches back of the connection and reclamp. Defective hose should never be used.

Torches and Blowpipes

Torches or blowpipes are built up of metal castings, forgings and tubing, usually brass or bronze. They should be of substantial design so as to withstand the rough handling they sometimes receive. It is best to use only those blowpipes which have been approved by underwriters' laboratories.

The gases enter the blowpipe by separate inlets. From these inlets each gas passes through a valve to the mixing chamber and from the mixing chamber passes to the outlet orifice, located in what is commonly termed the blowpipe tip. A number of interchangeable tips are provided with each blowpipe These tips have various size orifices and are selected for use according to size of work at hand.

The cutting torch or blowpipe differs from the welding blowpipe in that it has a different form of tip which provides for a separate jet of oxygen in addition to the mixed jet or jets or oxygen and combustible gas. The mixed jet is for preheating the metal, and the pure oxygen jet for cutting. The flow of oxygen to the cutting jet is controlled by a separate valve.

There are two types of blowpipes in general use, known as the "injector" or low-pressure type and the "pressure" or equal-pressure type. In the "injector' blowpipe the acetylene is drawn into the mixing chamber by the velocity of the oxygen, and may be supplied either from a low-pressure generator, a medium-pressure generator, or from cylinders. In the "pressure" blowpipe, the gases enter the blowpipe under pressure; therefore, the acetylene must be supplied from cylinders, or from a medium-pressure generator.

A common occurrence with blowpipes is that of back-firing a combustion of gases which takes place inside the blowpipe itself. The principal causes of back-firing are improper gas pressure and the clogging up of the tip by particles of dirt or oxide. Back-fires rarely occur if gas pressures recommended by the manufacturers are maintained, and if the blowpipes are properly manipulated. The greatest hazard from back-fires arises from the possibility of the flame being carried back into the acetylene generator. An approved hydraulic back-pressure valve (water seal) should be provided as a part of every generator installation These water seals, wherever located, should be regularly inspected at frequent intervals to see that they are properly filled with water.

When a back-fire occurs, both gases should be immediately shut off—first the oxygen, then the acetylene. If the blowpipe is overheated due to the back-fire cool it in a bucket of water. Before lighting up again see that the blowpipe is cool, and first blow a little oxygen through it to remove any carbon that may have accumulated owing to back-fire.

When welding on heavy work, blowpipes may become overheated from radiated heat and it is advisable to cool them periodically in a bucket of water. The combustible gas should be shut off before plunging the blowpipe into water, though the oxygen should be allowed to bubble through slowly to keep water from inside of blowpipe.

Hydrogen and carbohydrogen because of the rate of combustion of these gases have little tendency to flash back and consequently present little hazard from this source.

The procedure to be followed in lighting blowpipes varies with the design and style of the blowpipe employed. The instructions for lighting furnished by the manufacturers should be minutely followed. Small, handy lighters may be easily obtained for lighting blowpipes and are convenient and more safe than matches.

Never put down a blowpipe until the gases have been completely shut off. Blowpipes should never be hung from regulators or other equipment, so that they come into contact with sides of gas cylinders, as there is danger that the flame is not completely extinguished and would heat the cylinder, or might even burn a hole through it.

A fire extinguisher should be near at hand where welding is being done. It is advisable to carry one as regular equipment on all portable welding apparatus.

Eye Protection and Clothing

An important hazard in the use of the blowpipe or torch is that of injury to the eyes, by the heat and glare from the work and by particles of hot metal that fly up from the weld. Properly colored lenses fitted in goggles will furnish complete protection to the eyes. Workmen sometimes think they do better work without them, or are too indifferent to wear them, so the injury is done before it is realized.

Amber, yellow and greenish-yellow glasses are the most efficient for protection. The selection of lenses, however, should not be left to the workmen, nor even a foreman. Goggles with the proper lenses may be procured from several reliable manufacturers. The expensive colored lenses may be protected from injury from flying sparks, by a clear glass lens outside of each colored lens in the frame.

Goggle frames preferably should be of a material which is a non-conductor of heat. If metal frames are used, they should be padded. The frames should permit free air circulation, therefore have wire mesh or vent holes in the cups.

When working on heavy work for long periods of time, operators may be supplied with fireproofed gauntlet gloves and aprons, as a protection against the radiated heat. Woolen clothing is preferable to cotton, because it is not so easily ignited and protects the workman from changes in temperature. It is advisable, however, that the outer clothing (jumper or overalls) worn by all operators of a blowpipe or torch be fireproofed. Fireproofing may be cheaply and easily done.

There have been instances when the operator's clothing has been set on fire by sparks of molten metal which lodged in rolled-up sleeves, and in pockets of clothing. Operators should be warned to keep sleeves buttoned around the wrist and their collars buttoned to prevent lodgment of sparks. Some suggest that it is also advisable to eliminate pockets in front of overalls and aprons.

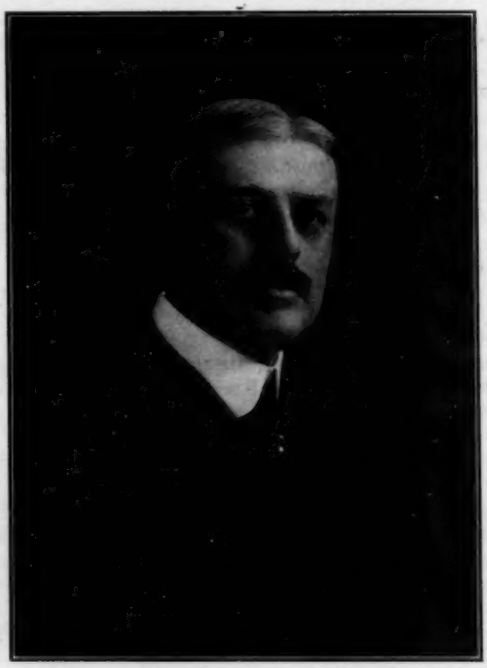
Stannard Elected Vice-President

Denver, Col.—Clare N. Stannard, secretary and commercial manager of the Denver Gas & Electric Light Company for many years, was elected March 26 to succeed the late W. J. Barker as vice-president and general manager of the concern.

R. G. Gentry, assistant commercial manager, was made commercial manager and Treasurer Harry Hughes was made acting secretary.

Mr. Stannard, who is fifty-four years old, has been with the company for twenty-four years, rising in that time from collector to general manager. He entered the employ of the Binghamton Gas & Electric Company, in Binghamton, N. Y., in 1888 and for seven years took the usual instruction course. He also served as superintendent of a street railway owned by the company. In May, 1897, he moved to Denver and entered the employ of the Denver City Tramway Company in the master mechanic's department. Later he was transferred to the auditing department. In 1898 he entered the employ of the Denver Consolidated Electric Company as a collector and soon was promoted to assistant cashier. When the Denver Gas & Electric Light Company was formed, he was made cashier. His next step upward was to the position of commercial manager, and in 1906 he was made secretary. A short time later, he was elected a director of the company. He also became secretary and a director of the Summit County Power company and assistant secretary of the Western Light & Power Company.

Mr. Stannard formerly was president of the National Commercial Gas Association and is a director of the National Electric Light Association. He is a life member of the Motor Club, treasurer of the exec-



utive committee of the Tourist Bureau, a member of the finance committee of the Civic and Commercial Association. He is a former president of the Denver Rotary Club and is a member of the Denver Athletic Club.

President Frank W. Frueauff presided at the meeting of the directors Monday afternoon when Mr. Stannard was elected vice-president and general manager.

Thrift Club Organized

Employees of the Oklahoma City division of the Oklahoma Gas & Electric Company have organized a Thrift Club. Employees from every department met on March 9, adopted by-laws and elected the following officers: President, H. L. Josey; secretary, E. B. Smith; treasurer, Lucille McBath. There are seventy charter members. The trustees, J. F. Owens, W. R. Emerson and A. A. Brown, have subscribed for forty shares of the company's 7 per cent preferred stock in the name of the club. Monthly payments will be made by small subscriptions from the employee members. A great deal of interest has been taken in the organization, and it is expected within the very near future to reach the 100 per cent mark.

Public Utilities Securities Market Report

Prices of Representative Gas Bonds

(Quotations furnished by The National City Company)

Company	Issue	Maturity	Apr. 6, 1922 Bid	Asked
American Lt. & Trac. Co.	Five Year 6s	May 1, 1925	104½	105½
Brooklyn Union Gas Co.	First Consol. 5s	May 1, 1945	92½	93
Columbia Gas & Elec, Co.	First 5s	May 1, 1927	92½	93
Consol. Gas, Elec. Lt. & Pr. Co. of Baltimore	First Ref. 7½s	Dec. 1, 1945	106	107
Consol. Gas, Elec. Lt. & Pr. Co.	General 4½s	Feb. 14, 1935	89¼	90
Consol. Gas Co. of New York	Sec. Conv. 7s	Feb. 1, 1925	109	109½
New Amsterdam Gas Co.	First Consol. 5s	Jan. 1, 1948	75	78
Denver Gas & Elec. Co.	Gen. (now 1st) 5s	May 1, 1949	91	93
Detroit City Gas Co.	Gold 5s	Jan. 1, 1923	97	99
Equitable Illum. Gas Lt. Co. of Philadelphia	First 5s	Jan. 1, 1928	98¾	99¾
Hudson County Gas Co.	First 5s	Nov. 1, 1949	87	89
Laclede Gas Light Co.	Ref. & Ext. 5s	Apr. 1, 1934	89	90
Louisville Gas & Elec. Co.	First & Ref. 7s	June 1, 1923	99½	100½
Michigan Light Co.	First & Ref. 5s	Mar. 1, 1946	88	90
Milwaukee Gas Light Co.	First 4s	May 1, 1927	91	91½
Pacific Gas & Elec. Co.	Gen. & Ref. 5s	Jan. 1, 1942	89	89½
Pacific Gas & Elec. Co.	First & Ref. 7s	Dec. 1, 1940	105½	106
Cal. Gas & Elec. Corp.	Unif. & Ref. 5s	Nov. 1, 1937	93¾	94½
Peoples' Gas Lt. & Coke Co.	Refunding 5s	Sept. 1, 1947	87½	88½
Chicago Gas Lt. & Coke Co.	First 5s	July 1, 1937	93	93½
Portland Gas & Coke Co.	First & Ref. 5s	Jan. 1, 1940	88	89
Seattle Lighting Co.	Refunding 5s	Oct. 1, 1949	83½	85
Southern California Gas Co.	First 6s	Nov. 1, 1950	94	98
Utica Gas & Electric Co.	Ref. & Ext. 5s	July 1, 1957	88	96
Washington Gas Light Co.	General 5s	Nov. 1, 1960	91	92½
Western States Gas & Elec. Co. of California	First & Ref. 5s	June 1, 1941	87¾	89

Improvement in Midway Gas Earnings

Los Angeles, Cal.—Annual earnings of the Midway Gas Company, which supplies Los Angeles with natural gas from the Buena Vista oil and gas fields and serves other cities as far north as Bakersfield, were $2,619,241 for 1921, a gain of $448,294 over 1920, according to the company's statement at its annual meeting held here recently.

New Bedford Gas

The New Bedford (Mass.) Gas & Edison Light Company has petitioned the Department of Public Utilities for approval of an issue of $1,500,000 first mortgage bonds bearing interest at not exceeding 6 per cent and maturing not later than Jan. 1, 1938. Proceeds are to be devoted to payment of a like amount of bonds falling due June 1, 1922.

Oakdale Gas Co. Report

San Francisco, Cal.—The Oakdale Gas Company, operating in Oakdale, reports for the year 1921 that its operating revenue was $21,175.94; operating expenses, $18,488.51; giving a net operating revenue of $2,687.43. Interest, rent and other deductions totaled $2,456.

The net corporate income for the year was $341.43. The surplus at the beginning of the year amounted to $3,440.89. The accumulated surplus at the end of the year amounted to $3,672.32.

Improvements for Ocean City

Ocean City, N. J.—The annual meeting of the stockholders of the City Gas Light Company was held at the office of the corporation here and the following directors were re-elected: L. C. Ritchie, George Burge, Lewis Thorn and H. C. Schanze, Jr., of Belmar; Andrew P. Maloney, of Philadelphia, and Thomas J. Thorn and James Austin, of this city.

The directors re-elected the following officers: President, L. C. Ritchie; vice-president, secretary and treasurer, H. C. Schanze, Jr.; assistant secretary, Miss Burnney, of Belmar.

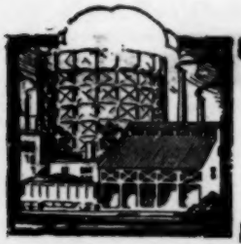
It is stated that the company is about starting a large number of extensive improvements at the plant and to its lines throughout the north section of the city. The new 6-ft. U. G. I. set has been installed at the plant and is in operation, and the plant, it is declared, is in first-class condition for the spring and summer business.

Main extensions are to be made at once in the Gardens section and various other parts of the resort.

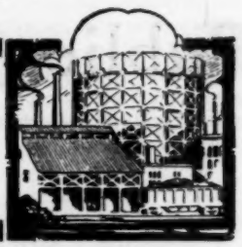
Greensboro Gas Co. Files New Rate Schedule

Harrisburg, Pa.—The Greensboro Gas Company has filed with the Public Service Commission a new tariff increasing rates to 53 cents gross or 50 cents net per 1,000 cu. ft., effective from April 1. The company furnishes service in Fayette, Greene, Washington and Westmoreland counties.

The commission has dismissed the complaint of the citizens of Jeannette against the Greensboro company who protested against the increase from 37 to 47 cents per 1,000 cu. ft. made on Jan. 15, 1921.



NEWS OF THE GAS INDUSTRY



Kings County Lighting Com- Company Voluntarily Reduces Rates

In relation to the action of the Public Service Commission in fixing a heating standard for gas supplied by his company, Ralph Elsman, president of the Kings County Lighting Company, issued the following statement:

"Following the action of the Public Service Commission in fixing a standard of 525 B.t.u. for this company, the Kings County Lighting Company has filed with the commission a schedule reducing its rate from $1.50 per thousand feet of gas to 14 cents per hundred feet, effective May 1, 1922. The schedule further provides for a minimum bill of 50 cents per month where the bill for gas at the rate would be less than 50 cents. This is not a service charge, for it will affect only those consumers who use 300 cu. ft. or less a month. It is only fair to regular consumers that these occasional users should pay a minimum bill. The present rate of $1.50 was based on the cost of making gas of a quality of 585 B.t.u The difference in cost between an average of 585 B.t.u. gas and a minimum of 525 B.t.u. gas is about 3 cents. The company, however, is voluntarily reducing the rate 10 cents. The consumers will find that the gas furnished by the company will be exceedingly satisfactory and efficient for all purposes.

"The territory served by the company is exceptional. Important rapid transit lines were constructed and put in operation during the war period. The resulting availability of this section has produced an extraordinary amount of building and a great increase in population attracted by the exceptional advantages of the territory. As proof of this, in 1921 the company added 4,300 new consumers. This year more buildings are under construction than last year, a greater amount of building than in any other part of Brooklyn. The years 1921 and 1922 will mean at least 10,000 new consumers, a growth for the company of over 25 per cent. This means a great increase in the business of the company, but to secure such business and to meet and anticipate this growth the company has expended in the last two years approximately $2,000,000 in the enlargement of its properties. The continuing territorial growth will call for substantial annual capital expenditures by the company. An adequate rate is essential to attract such capital. The company made these improvements under the handicap of a rate which during the war period was grossly inadequate, and although the present rate has not been fully adequate the company is anxious to aid in meeting the housing condition and therefore proposes the reduction in rate, without prejudice to its legal rights. The company desires thus to aid in the development of the territory and to co-operate with its builders, and particularly with the financial institutions that are making the loans whereby it is possible for the builders to proceed. It is confident that they recognize that just as they must be able to attract and to loan such capital, so the company must be able, by having an adequate revenue, to attract new capital needed to keep up with the district. It will, in addition, and as rapidly as possible, make future changes in its rate based upon the reductions and economies in costs, with proper consideration for an adequate return. The company cannot prophesy as to the outcome of the coal situation, but with favorable conditions as to materials it expects to be able to announce in the fall a further change in its rate. It hopes that its consumers and the builders will appreciate the efforts of the company to keep pace with the territory in service and in rates."

Natural Gas Rate Increase Is Granted

Batavia, N. Y.—Batavia's natural gas rate has been increased from 60 to 70 cents a thousand cubic feet through the order granted the Republic Heat, Light & Power Company by the Public Service Commission. The new rate is given as a net rate and nothing is said about a discount for prompt payment of bills. Heretofore the company gave a 5 per cent discount for all bills paid by the 10th of the month, which virtually brought the price to 55 cents. Thus the present rate is practically an increase of 15 cents a thousand. The continuance of the present minimum monthly charge of $1 a month is also granted in the order. The new rate will remain in effect for a year, and thereafter until the commission should make a further order. Other towns in Genesee County and western New York are similarly affected.

The many arguments put forth against the increase in which the gas company asked for 90 cents a thousand feet at the various hearings held on the question in Buffalo had little or no effect with the commission. The gas company has a franchise in Batavia which called for furnishing gas at 35 cents a thousand feet and which had been in effect several years, and was increased to 60 cents a year ago. The franchise has been completely ignored by both the gas company and the Public Service Commission.

Abandoned Oil Well Causes Excitement Near Ringgold

A well drilled by the Arkansas Natural Gas Company while prospecting for oil on lands belonging to S. L. Carter, near Ringgold, La., in 1918 caused a great deal of excitement in that vicinity last week, when it blew off the cap and was reported to be making a strong showing of gas and some oil. It was reported at the time of the drilling that those in charge of operations drilled through a good showing of oil in the hopes of bringing in a well at a greater depth.

This well is near the Butler well that came in, making about 5,000,000 ft. of casing-head gas.

Personal Notes

G. A. Bubb, at one time foreman of the gas producing plant in Watertown, N. Y., operated by the Northern New York Utilities, Inc., has recently been placed in charge of the gas department of the Adirondack Power & Light Corporation, distributing in Glens Falls, Hudson Falls and Fort Edward, N. Y.

E. W. Frisbie, at one time with the New York State Gas & Electric Company, of Corning, N. Y., and of late sales engineer in charge of the gas and electric fixtures department of the Northern New York Utilities, Inc., with headquarters in Watertown, N. Y., has resigned that position, to take effect at once.

Prof. Lockwood N. Street, of Syracuse University, consulting engineer in the Bureau of Gas and Electricity of Syracuse, has filed his resignation with Commissioner of Public Safety James B. Spencer. E. E. Tilton has been appointed to the position temporarily, or until such a time as an examination may be held and a candidate selected from eligible list.

H. L. Smith, one of the industrial engineers of the Equitable Gas Company, Pittsburgh, Pa., has been transferred to the Allegheny Heating Company as general foreman.

C. P. Long has joined the ranks of the sales department, Equitable Gas Company, as a cadet engineer.

H. C. Cooper, Clarksburg, W. Va., superintendent of the Hope Natural Gas Company, is a member of the board of registration for engineers of West Virginia. The board was provided by a recent legislative act of the State of West Virginia, its duties being to examine credentials and to register all engineers practising in the State. The other members of the board are: C. S. MacCalla, vice-president and general manager of the Virginia Power Company, who is serving as chairman in place of W. J. Priestly, metallurgical engineer, Charleston, W. Va., unable to serve on the board because of civil service law; Frank Haas, Fairmont, W. Va., consulting engineer; N. H. Manakee, Bluefield, W. Va.; George Taylor, consulting engineer, Charleston-Kanawha, W. Va., also president of the Charleston Chapter of the Association of American Engineers.

P. F. McEnaney Made Active Head of Superior Meter Co.

P. F. McEnaney, who was recently elected acting treasurer and active head of the Superior Meter Company, Brooklyn, N. Y., to fill the vacancy caused by the death of John Smith, was born in Brooklyn and received his early education in the public schools and the Manual Training High School of that borough. He is a graduate of the chemical and mechanical engineering courses of the Polytechnic and the Pratt institutes of Brooklyn.

P. F. McEnaney

For five years he was connected with the chemical and manufacturing departments of the Brooklyn Union Gas Company, in charge of special chemical and manufacturing and distribution work.

He spent three years in the oxygen, hydrogen and acetylene fields, manufacturing and selling this type of equipment for manufacturing, compressing, distribution and repair work.

During the war he was expert adviser on the high-pressure compression of poisonous gases.

Since 1920 he has been in the meter game, and was chief engineer of the Superior Meter Company at the time of the death of Mr. Smith.

D. J. Hennessy has been appointed assistant to the controller of the Philadelphia Company and affiliated corporations, Pittsburgh, Pa., assuming the duties of A. E. Dedrick, resigned.

Ralph Rainsford, chief engineer, Philadelphia Company, has appointed the following division chiefs of the engineering department: W. C. Boyd, assistant engineer, street railway division; P. A. Young, assistant engineer, mechanical division; M. R. Scharff, assistant engineer, valuation

division; H. L. Fullerton, assistant engineer, electrical division; F. N. Gormley, assistant engineer, underground division; N. O. Smith-Peterson, assistant engineer, drafting division; Fred L. Fast, assistant to chief engineer.

OLIVER BROWN, of South Bend, Ind., has been in the gas business there a little more than half a century. He began with the gas plant that operated in the Indiana town in 1871, when it was started, one of his jobs at that time being that of riding a big truck horse about the town, which then had 10,500 people, and putting out the street lights. In the day-time the horse was used for delivering coke from the gas plant to the citizens who bought the product Lamp lighters in those days were paid $1 a week and had to provide their own matches. Gas inspectors turned off the gas at a certain hour every evening, and folks who were "sitting up" or playing euchre had to have candles or kerosene lamps ready to take up the work of the gas, or else they wound up their festivities very abruptly. The gas plant at South Bend was started originally by the Studebakers. It is now owned by the Northern Indiana Gas & Electric Company, and Guy M. Johnson is the superintendent. It has a gas-making capacity of 5,950,000 cu. ft. daily and a holder capacity of 1,500,000 cu. ft. The company now employs 120 men.

PETER WARD, after giving forty-eight years of continuous service, has been placed on the service honor roll of the Consolidated Gas, Electric Light & Power Company, Baltimore, Md. The greater part of Mr. Ward's service was spent at the gas manufacturing plant at Spring Gardens in the capacity of pressureman. He started in as a laborer at Spring Gardens and afterwards became pressureman and watchman (this was in 1892), in which capacity he served until 1916, when he became pressure regulator at the Bayard Street station. Mr. Ward has one of the longest service records of all the employees of the gas department.

GEORGE G. KINES, valve-house operator at the Bayard Street gas station of the Consolidated Gas, Electric Light & Power Company, Baltimore, Md., has been retired after having been connected with the gas manufacturing department for thirty-two years. Mr. Kines' first employment was at the Spring Gardens station, Nov. 23, 1889, as a general mechanic. He was later promoted to the position of foreman of gas manufacture. In 1918 he was transferred to the Bayard Street holder. In ceasing his activities with the company Mr. Kines carried with him its best wishes and those of his coworkers.

ARTHUR M. HEARD has been elected president, Thomas R. Varick vice-president and Walter M. Africa treasurer of the Manchester (N. H.) Gas Company, just organized following authorization of the consolidation of the Manchester Light Company and the People's Gas Light Company, both of this city. Permission for the move was granted a month ago by the State Public Service Commission. Charles C. Hayes, Albert L. Clough, Nathan P. Hunt, Walter M. Parker and W. Byron Stearns, of Manchester, and G. W. Curran, of Philadelphia, have been named directors of the company.

LUZERNE COUNTY GAS & ELECTRIC COMPANY, Plymouth, Ga., has arranged for a bond issue of $1,000,000, a portion of the proceeds to be used for extensions and improvements in its power plant and system.

PACIFIC GAS & ELECTRIC COMPAN'S report for the two months ended Feb. 28 shows operating revenues $6,737,689, increase $118,999 and operating income $2,658,785, increase $219,307. After deduction of fixed charges there was a net income of $1,137,586, increase $88,411, and after payment of preferred dividends the balance available for the common stock was $728,968, increase $22,660.

AMERICAN GAS & ELECTRIC COMPANY, regular quarterly dividends of 2½ per cent on the common, payable April 1, record March 18, and 1½ per cent on the preferred, payable May 1, record April 13.

MADISON (Wis.) GAS & ELECTRIC COMPANY will take bids within a few days for an addition to its steam generating plant to produce 5,000-kw. additional energy. The work is in charge of Mead & Seastone, consulting engineers, Madison. Equipment requirements include a 1,000-h.p. Sterling boiler, automatic stoking equipment, coal-handling machinery, bunkers, etc.

Gas Company Manager Is Banquet Guest

Asbury Park, N. J.—About eighty employees of the Consolidated Gas Company from Long Branch, Asbury Park and Red Bank gathered recently at the Cake Shop Restaurant in celebration of the tenth anniversary of F. R. Cutcheon, vice-president and general manager. An elaborate banquet, served under the personal direction of Mrs. Cook, was followed by a social evening, with dancing and speechmaking.

A. H. Hagerman, superintendent of the Asbury Park branch, acted as toastmaster, and after a few brief remarks introduced General Superintendent De Quine of the Long Branch district, who, after a few very fitting remarks, introduced Mr. Cutcheon and presented him with a basket of cut flowers. Mr. Cutcheon responded, during applause, and thanked the employees for the honor which was bestowed upon him, and appeared highly pleased at the good feeling which existed between the employees and the company.

Henry C. Erwin, treasurer, gave a short talk upon the growth of the company, and Secretary H. N. McKaig, who has just passed the twenty-year-service mark, outlined the progress and efficiency in his departments.

The last speaker was H. E. Mason, efficiency man, who has always looked after the social welfare of the employees, and is enthusiastic over the bowling teams. Music was supplied by the Harmony Club.

Some Natural Gas Findings

In Panola County, Texas, the Industrial Oil & Gas Company has completed an 18,000,000 cu. ft. gasser. This big gasser is known as No. 1 Lowless.

In Webb County, Texas, eight miles north of Torrecillas, the Carolina-Texas Oil Company, drilling the well known as the Barnsley No. 1, brought in a 25,000,000 cu. ft. gasser.

Sues Gas Company

Worcester, Mass.—Anna T. Jones, of Worcester, has entered a suit in the superior court to recover damages of $4,000 from the Worcester Gas Light Company. She alleges she fell and was hurt on Jan. 22, 1920, by reason of a defect in a passageway maintained by the company. Attorney D. F. O'Connell, Worcester, represents the plaintiff.